BURNS McDONNELL

Interim Measures Work Plan SWMUs 4, 7, and 33 and AOC 8

AK Steel
Kansas City Facility

Project No. 84734

Final
December 2015

AK Steel Corporation
Environmental Affairs
9227 Centre Pointe Drive
West Chester, Ohio 45069

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AWMD/RCAP

December 18, 2015

Mr. Bruce Morrison, Project Manager
Waste Remediation and Permitting Branch
Air and Waste Management Division
United States Environmental Protection Agency - Region VII
11201 Renner Boulevard
Lenexa KS 66219

Re: HSWA Corrective Action Permit Number MOD 007 118 029
Final Interim Measures Work Plan, SWMUs 4, 7, and 33 and AOC 8
AK Steel, Kansas City, Missouri

Dear Mr. Morrison:

AK Steel is submitting to the Environmental Protection Agency (EPA) and the Missouri Department of Natural Resources (MDNR) the *Final Interim Measures Work Plan, SWMUs 4, 7, and 33 and AOC 8,* which was prepared by Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) at our direction. This document was prepared in response to EPA's August 11, 2015 letter regarding "Comments on the Interim Measures Work Plan for SWMUs 4, 7, 33 and AOC 8 for the AK Steel Site, Kansas City, Missouri" and October 27, 2015 letter regarding "Schedule for RCRA Corrective Action at the AK Steel Site, Kansas City, Missouri".

CERTIFICATION:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

This Report and Certification are submitted on behalf of AK Steel Corporation.

Very truly yours,

Patrick Gallo
Sr. Environmental Manager of Environmental Affairs

cc: C. Kump-Mitchell – MDNR (1 Copy)
J. El-Jayyousi - MDNR (2 Copies)
S. L. Shelton – Burns & McDonnell

Interim Measures Work Plan
SWMUs 4, 7, and 33 and AOC 8

prepared for

AK Steel
Kansas City Facility
Kansas City, Missouri

Project No. 84734

Final
December 2015

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
AAMP	Ambient Air Monitoring Plan
American	American Properties LLP
AOC	Area of Concern
ASTM	American Society for Testing and Materials
bgs	below ground surface
BMcD	Burns & McDonnell
BMWCI	Burns & McDonnell Waste Consultants, Inc.
CAO	Corrective Action Objective
CBB	Compass Big Blue LLC
CFR	Code of Federal Regulation
cis-1,2-DCE	cis-1,2-dichloroethylene
CMS	Corrective Measures Study
CMS Report	*Draft Corrective Measures Study Report for SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, 33, and AOCs 1, 4, and 8, AK Steel, Kansas City, Missouri*
COC	contaminant of concern
CSM	Conceptual Site Model
CY	cubic yard
DNAPL	dense non-aqueous phase liquid
DPE	dual phase extraction
Facility	AK Steel Facility, Kansas City, Missouri
GST	GST Technologies Operating Company, Inc.
GPS	Geographic Positioning System
Hansen	Hansen Property Development, Inc.
HSWA	Hazardous and Solid Waste Amendment
I-435	Interstate Highway 435
IM	Interim Measure
IMO	Interim Measure Objective
MCL	Maximum Contaminant Level
MDNR	Missouri Department of Natural Resources
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	monitored natural attenuation
MoECA	Missouri Environmental Covenants Act
OSHA	Occupational Safety and Health Administration
Permit	HSWA Part B Post-Closure Permit
PRG	Preliminary Remediation Goal

Abbreviation	Term/Phrase/Name
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFI Report	*RCRA Facility Investigation Report, Armco Kansas City Facility*
RSL	regional screening level
SPLP	synthetic precipitation leaching procedure
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TCE	trichloroethylene
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

* * * * *

1.0 INTRODUCTION AND PURPOSE

Burns & McDonnell Engineering Company, Inc. (BMcD) has prepared this Interim Measures (IMs) Work Plan on behalf of AK Steel (former Armco Inc.[1]). RCRA corrective action requirements for AK Steel's Kansas City Facility (Facility) are outlined in AK Steel's Hazardous and Solid Waste Amendments (HSWA) Part B Post-Closure Permit (Permit), which was issued by the United States Environmental Protection Agency (USEPA) Region 7 on November 30, 1994 (USEPA ID# MOD 007118029). AK Steel previously conducted a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) and a Supplemental Investigation at the Facility. The results of these investigations were summarized in the *RCRA Facility Investigation Report, Armco Kansas City Facility* (RFI Report) (Burns & McDonnell Waste Consultants, Inc. [BMWCI], 1999) and *Supplemental Investigation Report, AK Steel, Kansas City, Missouri* (BMcD, 2008). The USEPA and Missouri Department of Natural Resources (MDNR) have approved both of these documents in combination to satisfy Special Permit Condition XXX presented in Part II of the Permit.

At the request of USEPA and to satisfy Special Permit Condition XXXIII, AK Steel subsequently submitted a *Corrective Measures Study Report* (BMcD, 2013a) to identify, evaluate, and recommend corrective action alternatives to remediate contamination at Solid Waste Management Units (SWMUs) 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, and 33; and Areas of Concern (AOCs) 1, 4, and 8. Following the collection of additional data to evaluate corrective action alternatives at Solid Waste Management Units (SWMUs) 6, 24, and AOC 4, USEPA requested that AK Steel initiate interim measures (IMs) at SWMUs 4, 7, and 33 and AOC 8 (USEPA, 2014). In a letter dated May 5, 2015, USEPA required AK Steel to submit an IM Work Plan for SWMUs 4, 7, 33 and AOC 8 by July 20, 2015 to satisfy Special Permit Condition XXXI(D). This IM Work Plan presents a summary of IMs planned for SWMUs 4, 7, and 33 and AOC 8.

1.1 Purpose and Scope

In accordance with Section XXXI(D) of Part II of the Permit and in response to USEPA's December 3, 2014 and May 5, 2015 letters, AK Steel is submitting this IM Work Plan for SWMU 4, SWMU 7, AOC 8, and SWMU 33. This IM Work Plan was prepared in general accordance with requirements presented in USEPA's *RCRA Corrective Action Plan* for Conceptual Designs (15 percent Design Point) and is intended to describe the size, shape, form, and content of the proposed corrective measures; the key components or elements that are needed; and the intended vision of the corrective measure in the form of

[1] Effective September 30, 1999, Armco Inc. was merged with and into AK Steel Corporation, a Delaware Corporation with headquarters in West Chester, Ohio.

a conceptual site model (CSM) or other schematic; as well as present procedures and schedules for the implementation of the corrective measures (USEPA, 1994). As defined in USEPA's letters dated December 3, 2014 and May, 5, 2015, the scope of this report includes the following SWMUs and AOCs that are located on AK Steel property:

- SWMU 4 – 1987 Waste Pile
- SWMU 7 – No. 1 Melt Shop Baghouse Dust Tanks
- SWMU 33 – Nail Mill Degreasing Area
- AOC 8 – "Owl Gun Club" Shooting Park

1.2 IM Work Plan Organization

This IM Work Plan has been prepared by BMcD and consists of one volume. This document is organized as follows:

- Section 1.0 – Introduction and Purpose
- Section 2.0 – Interim Measure Objectives
- Section 3.0 – Conceptual Model of Contaminant Migration
- Section 4.0 – Description of Interim Measures
- Section 5.0 – Project Management/Schedule
- Section 6.0 – Design Criteria
- Section 7.0 – Design Basis
- Section 8.0 – References
- Tables
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- Appendix A – Technical Specifications

1.3 Facility Background

1.3.1 Facility Location

This section presents a summary of the Facility location and history to provide context to the IMs presented herein. Figure 1-1 presents a Facility Location Map. The Facility is located in northeast Kansas City, Missouri within the Blue River and Missouri River floodplains. Portions of the Facility are located both east and west of Interstate Highway 435 (I-435). Industrial activities were performed exclusively in the area west of I-435, north of 12th Street, and east of Ewing Avenue. The area east of I-435 is largely undeveloped land that is included within the proposed right-of-way for the Lewis and

Clark Expressway. This area was historically associated with ancillary activities such as waste management and materials transportation. Figure 1-2 depicts the Facility, and presents ownership and operational changes that have occurred since issuance of the Permit. The current physical address for the Facility is:

AK Steel
7000 Winner Road
Kansas City, Missouri 64125

1.3.2 Facility History

The Kansas City Bolt and Nut Company first occupied the area in 1888. This company manufactured iron bolts and nuts from purchased iron until the early 1920s when open-hearth furnaces were installed. After that time, the company pioneered the production of carbon steel products from 100-percent recycled scrap iron and steel. The company's name was changed in 1925 from the Kansas City Bolt and Nut Company to Sheffield Steel Corporation, and the company became a subsidiary of Armco Steel Corporation in 1930.

In 1951, Armco completed construction of the No. 1 Melt Shop, which produced steel from 100 percent scrap using electric arc furnace technology. Additional electric arc furnaces were installed in the No. 1 Melt Shop in the mid-1950s and early to late 1960s, for a total of four electric arc furnaces. In 1959, production of steel in open-hearth furnaces was discontinued, and the open-hearth furnaces were later demolished.

Steel ingots produced in both open-hearth and electric arc furnaces were rolled in the 32" Blooming Mill and 18" Rolling Mill to produce billets that were primarily used as feed stock for other plant operations. The 12" Merchant Bar Mill was built and began production in the early 1950s to supplement the 10" Finishing Mill. In 1957, the Rod Mill was built and placed in operation.

A second melt shop complex was built and placed in operation in 1976. The complex included the No. 2 Melt Shop (with two additional electric arc furnaces), a continuous caster, and a 19" Rolling Mill. By 1977, Armco's Kansas City steel production operations included six electric arc furnaces in two melt shops, a blooming mill, and a continuous caster. A multitude of semi-finished and finished products were produced by the 19" Rolling Mill, the 12" Finishing Mill, the Rod Mill, the Wire Mill, the Nail Mill, the Bolt and Nut Plant, and the Grinding Media Facility. A ladle arc refining facility was added to the No. 2 Melt Shop operation in 1989. Economic conditions in the steel industry affected Armco's Kansas City plant, and the diversity of operations was slowly reduced.

By 1993, Armco's Kansas City plant had continued to grow in production tonnage, but production was limited to semi-finished steel products and a minor amount of finished steel products. Historically, the plant operations and property owned by Armco (now AK Steel) totaled approximately 860 acres. Production facilities and a portion of the plant real estate were sold to GST Technologies Operating Company, Inc. (GST), which was doing business as GST Steel Company, on November 12, 1993. Armco retained ownership of approximately 560 acres and GST leased approximately 100 acres of this property. GST operated facilities on both purchased and leased property until they filed for bankruptcy in April 2001. There are no active manufacturing operations or activities on the property retained by AK Steel. As part of the bankruptcy proceedings, GST sold the majority of their holdings to Compass Big Blue LLC (CBB).

In the ensuing years, the CBB tracts have been sold to House of Burgesses LLC, CTE Properties LLC, Smorgon Steel Grinding Systems LLC[2], Blue Summit LLC, and/or The Andersons, Inc.. Businesses currently operating on these former CBB parcels include:

- A large metal scrapping operation, Midwest Scrap Management, has been sited on the property owned by House of Burgesses LLC.
- A truck and equipment sales and rental company is present on the CTE Properties LLC parcel.
- A steel grinding ball manufacturing operation is present on the parcel owned by OneSteel, and it is currently doing business as Moly-Cop.
- An environmental and rail service company, specializing in rail car cleaning and maintenance, is located on the The Andersons, Inc. parcel.
- Blue Summit LLC appears to be operating a mill scale excavation and beneficial reuse business on its parcel.

In addition, approximately 20 acres of GST's property were sold to American Properties LLP (American) during the bankruptcy proceedings, and this property has subsequently been sold to Hansen Property Development, Inc. (Hansen). A U-Pick-It salvage yard currently operates on the Hansen parcel.

Lastly, AK Steel sold 15.8 acres of property that is south of 24 Highway and west of the Blue River to CTE Properties II, LLC in February 2013. This area is being used for an expansion of a truck and equipment sales and rental company.

[2] Smorgon Steel Grinding Systems LLC merged with OneSteel Limited in August 2007. Moly-Cop Grinding Media, a division of OneSteel, currently operates this parcel.

The ownership and operation of these former GST tracts are now the responsibility of Hansen, House of Burgesses LLC, CTE Properties LLC, CTE Properties II LLC, Moly-Cop, , and/or Blue Summit LLC; however, certain SWMUs and AOCs are listed in AK Steel's Permit for purposes of RCRA Corrective Action. The property ownership and operational changes since the initial permit application and issuance are shown on Figures 1-2 and 1-3.

1.3.3 RCRA Permit History

From July 1980 through January 25, 1983, an Emission Control Dust Landfill (RCRA Landfill or SWMU 1) was operated by Armco at the Facility. During this period the landfill received approximately 29,190 tons (36,000 cubic yards [CY]) of hazardous waste identified by waste code K061. The waste, which was generated by melting scrap iron and steel in the plant's six electric arc furnaces, was collected in baghouse air pollution control systems and transported to the landfill for disposal. The landfill was certified as closed on September 19, 1984. Management of this closed landfill is outlined in AK Steel's Permit. Part I is the final RCRA Hazardous Waste Facility Post-Closure Permit issued by the MDNR with an effective date of February 16, 1994. Part II is the HSWA Corrective Action Permit issued by the USEPA Region VII with an effective date of December 1, 1994.

1.3.4 Tasks Completed to Date

Multiple environmental investigations have been performed at the Facility. A summary of Facility investigations and studies is provided in the following paragraphs:

- 1996 – 1998: Investigations conducted from 1996 through 1998 include an IM investigation and RFI. Results of these investigations were summarized in the *RCRA Facility Investigation Report, Armco Kansas City Facility* (BMWCI, 1999).

- 2001: A groundwater sampling event was conducted in 2001 for monitoring wells associated with SWMU 33, Nail Mill Degreasing Area. Results for this sampling event were presented in *Groundwater Monitoring Report, February 2001 Sampling Event, AK Steel Kansas City Facility*, which was an attachment to *First Quarter 2001 Progress Report* (BMcD, 2001).

- 2007: An investigation that was supplemental to the RFI was conducted in 2007. Soil and/or groundwater samples were collected from SWMUs 2, 3, 6, 7, 9, 12, 13, 17, 27, and 33 and AOCs 4 and 8. Results for this investigation were presented in the *Supplemental Investigation Report, AK Steel, Kansas City, Missouri* (BMcD, 2008).

- 2010: In 2010 supplemental soil sampling activities were conducted at SWMU 33, Nail Mill Degreasing Area, for purposes of designing a pilot study for remediation of chlorinated solvents in soil. Results of the soil investigation were presented in the *Supplemental Investigation Addendum Report and Pilot Study Work Plan for the SWMU 33 Nail Mill Degreasing Area Soil Investigation for AK Steel, Kansas City, Missouri* (BMcD, 2010b).

- 2011: Subsequent to the SWMU 33 supplemental soil investigation, a soil vapor extraction (SVE) and dual phase extraction (DPE) pilot test were conducted in the vicinity of the former degreaser. Results of the pilot test were presented in the *SVE/DPE Pilot Test Evaluation for the SWMU 33 Nail Mill Degreasing Area, AK Steel, Kansas City, Missouri* (BMcD, 2011).

- 2012: At the request of USEPA, surface material sampling was performed as SWMUs 13, 17, and 33 in March 2012. In addition, six monitoring wells were installed in the vicinity of SWMUs 2 and 4, and groundwater samples were collected in February and August 2012. Results of these sampling events were presented in the *Additional Sampling of SWMUs 2, 4, 13, 17, and 33 Report, AK Steel, Kansas, Missouri* (BMcD, 2012a) and *August 2012 Groundwater Sampling Report, SWMUs 2 and 4, AK Steel, Kansas City, Missouri* (BMcD, 2012b).

- 2013: Groundwater sampling events for six monitoring wells in the vicinity of SWMUs 2 and 4 was conducted in March and September 2013. Results of these sampling events were presented in the *March 2013 Groundwater Sampling Report, SWMUs 2 and 4, AK Steel, Kansas City, Missouri* (BMcD, 2013b) and the *September 2013 Groundwater Sampling Report, SWMUs 2 and 4, AK Steel, Kansas City, Missouri* (BMcD, 2013c).

- 2013: A corrective measures study (CMS) was developed for several SWUMs and AOCs located on property currently owned by AK Steel. The results of the study were presented in *Draft Corrective Measures Study Report for SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, 33, and AOCs 1, 4, and 8, AK Steel, Kansas City, Missouri* (CMS Report) (BMcD, 2013a). USEPA and MDNR issued comments to this document in December 2013 (USEPA, 2013).

- 2014: To address data gaps identified in the CMS Report (BMcD, 2013a), additional investigation activities were proposed for the Former Tank Farm (SWMU 6, SWMU 24, and AOC 4) and SWMU 17 in the *Quality Assurance Sampling and Analysis Plan, Additional Sampling Former Tank Farm and SWMU 17, AK Steel – Kansas City, Missouri* (BMcD, 2014a). Soil investigation at the Former Tank Farm and monitoring well installation at SWMU 17 were conducted in June 2014 and reported in October 2014 (BMcD, 2014b).

- 2014: Supplemental shallow soil investigation was performed at SWMU 12 by AECOM, as a consultant to BP, to better characterize the nature and extent of contamination in the 0 to 1 foot soil interval for purposes of ecological risk evaluation and CMS evaluation (AECOM, 2014).

- 2014-2015: Groundwater monitoring wells installed in the vicinity of SWMUs 17 and 33 were sampled quarterly to characterize chlorinated volatile organic compounds (VOCs) in groundwater. Groundwater samples were collected from the SWMU 33 and 17 monitoring well network in June/July 2014, September 2014, December 2014, and March 2015. Results of these sampling activities were presented in quarterly groundwater monitoring reports submitted to USEPA by BMcD (BMcD, 2014b, 2014c, 2015a, and 2015b).

1.4 Environmental Setting

The environmental setting for the Facility was previously described in Section 2 of the RFI Report (BMWCI, 1999).

* * * * *

2.0 INTERIM MEASURES OBJECTIVES

Interim measure objectives (IMOs) are based upon the Corrective Action Objectives (CAOs) presented in the *Draft Corrective Measures Study Report SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, and 33 and AOCs 1, 4, and 8* (BMcD, 2013a) and are designed to protect human health and the environment. CAOs are media-specific goals for protection of human health and the environment that provide the foundation upon which remedial alternatives for a SWMU/AOC were identified, assembled, and evaluated. During the development of CAOs, appropriate consideration was given to the contaminated media, receptors and exposure pathways, and media cleanup standards. By basing IMOs on the CAOs presented in the CMS Report (BMcD, 2013a), the IMs presented in here may also serve as part of final corrective measures at a later date. IMOs and CAOs can be achieved by eliminating exposure pathways associated with environmental media, enacting engineering and institutional controls that serve to eliminate exposure pathways associated with environmental media, or by removing the source of contamination. A description of the IMOs used in developing the conceptual designs for IMs are presented below.

2.1 Target Media Cleanup Standards (Numerical Standards)

Media cleanup standards are site-specific concentrations of individual hazardous constituents in a given medium that should be achieved as part of a remedy. For regulated units (i.e., SWMUs), the owner/operator should provide information to support USEPA's selection and development of media-specific protection standards for constituents found at the SWMU. The protection standards are derived from site-specific chemical, media, and future land use considerations. A discussion of how target media cleanup standards were developed for the Facility is presented in Section 4.1 of the CMS Report (BMcD, 2013a).

Under the existing conditions, land use near the Facility is characterized by medium to heavy industrial development, and the Facility is zoned M1-5 – Manufacturing 1, with a land use of "3110 – Heavy Industry" as designated by the city of Kansas City, Missouri. Current land use generally reflects that zoning designation. Overland access to the Facility by the public is limited by perimeter fencing, gates, and guards throughout most of the Facility. The Facility is marginally accessible from adjacent railroads, the Blue River, the Missouri River, and Rock Creek. The majority of the Facility lies within the 100-year floodplain. Groundwater is not used for any purpose at the Facility, and potable water is supplied by the city of Kansas City, Missouri; however, there are currently no restrictions in place to prevent the installation of an industrial water supply well.

The IMOs presented below were developed based upon current Facility uses which have been consistent for decades and are not anticipated to change in the foreseeable future. As outlined in USEPA's December 3, 2014 letter, USEPA and MDNR envision implementing an environmental restrictive covenant via the Missouri Environmental Covenants Act (MoECA) to address the SWMUs and AOCs owned by AK Steel once IMs have been implemented at the Facility (USEPA, 2014). Therefore, the IMs selected for implementation at SWMU 4, SWMU 7, SWMU 33 and AOC 8 in this IM Work Plan do not include land use restrictions limiting future use of the property to non-residential land scenarios. Since these land use restrictions are planned as part of the final remedy for the Facility, the assumption that future land use will be limited to non-residential scenarios used in this IM Work Plan is justified.

2.1.1 Media Cleanup Standards – Soil, Non-Residential Land Use Restrictions

As previously stated, land use near the Facility is characterized and zoned as medium to heavy industrial use, and this designation has been in place for decades. It is the intention of AK Steel to establish a non-residential land use restriction, such as through application of MoECA covenant, to maintain the use of the Facility as an industrial property. Therefore, IMs presented herein were conceptualized considering the following "non-residential land use" soil media cleanup standards as IMOs for soil:

- Soil – SWMUs and AOCs West of I-435 (Table 2-1): Under a non-residential land-use scenario, the media cleanup standards for SWMUs 7 and 33 are the USEPA regional screening levels (RSLs) for industrial soil. Exceptions will be made for lead, which has a site-specific preliminary remediation goal (PRG), and for arsenic and benzo(a)pyrene, which have Blue Valley Industrial Corridor background values above the USEPA RSLs for industrial soil.

- Soil – SWMUs and AOCs East of I-435 (Table 2-2): Under a non-residential land use scenario, the media cleanup standards for SWMU 4 and AOC 8 will be the lesser of the USEPA RSL for industrial soil or the USEPA Region 5 ecological screening level. Exceptions will be made for cadmium and lead, which have a site-specific ecological PRGs, and chromium and benzo(a)pyrene, which have Blue Valley Industrial Corridor background values above the USEPA Region 5 ecological screening levels and/or USEPA RSLs for industrial soil.

The development of media cleanup standards for non-residential soil is consistent with USEPA's interpretation of non-residential closure assumptions outlined in *Memorandum: Risk-Based Clean Closure* (USEPA, 1998).

2.1.2 Media Cleanup Standards – Groundwater

The numerical IMOs for groundwater are presented on Table 2-3. This table presents media cleanup standards for constituents that have been detected in groundwater samples at the Facility. The IMOs are based on the following conventions:

- The analytical data for groundwater will be screened using the Safe Drinking Water Act Maximum Contaminant Levels (MCLs) for constituents that have MCLs.
- If a constituent does not have a MCL, then the USEPA RSL for tapwater (USEPA, 2015) will be used for the groundwater media cleanup standard.

2.2 Non-Numerical Cleanup Standards

The following non-numerical IMOs were also selected and are based upon CAOs presented in Section 4.2 of the CMS Report (BMcD, 2013a):

- Reduce and manage potential human health risks potentially associated with Facility-related constituents in soil and groundwater, such that:
  - The excess lifetime cancer risk associated with chemical exposure is within the USEPA 1E-04 to 1E-06 (one in 10,000 to one in a million) risk management range.
  - The hazard index for risks associated with non-carcinogenic chemical exposures is less than or equal to one (≤ 1).
- Eliminate, reduce, or control potential adverse ecological impacts due to constituent concentrations in soil at AOC 8 and SWMUs 4, which are east of I-435, while balancing adverse ecological impacts that may result from remediation activities as presented in the *Interim EPA Region 7 Green Cleanup Policy* (USEPA, 2009).
- Eliminate, reduce, or control the potential for migration of Facility-related constituents in soil to groundwater such that groundwater media cleanup standards are not exceeded.

2.3 Compliance Points

Points of compliance are the site-specific locations at which the concentrations of individual constituents should meet the media cleanup standards for the IM to be considered effective. For surficial exposure scenarios (i.e., direct contact with soils or groundwater, inhalation of vapors, etc.), the point of compliance will likely be established within the SWMU or AOC boundary. The points of compliance for exposures based on migration of contamination within groundwater are expected to be the downgradient

boundary of the SWMU or AOC, consistent with 40 Code of Federal Regulations (CFR) 264.95. Points of compliance for each SWMU and/or AOC are outlined on Table 2-4.

* * * * *

3.0 CONCEPTUAL MODEL OF CONTAMINANT MIGRATION

This section presents CSMs for Areas West of I-435 (SWMU 7 and SWMU 33) and Areas East of I-435 (SWMU 4 and AOC 8). The CSMs have been developed to present the current conceptual understanding of the source(s) of contamination for each area, likely transport mechanisms effecting contaminant migration, and anticipated future contamination migration scenarios that may result in the spread of, and exposure to, known contaminants of concern (COCs). These conceptual models are based upon a professional understanding of the environmental setting, contaminate distributions as determined through historical sampling efforts, fate and transportation mechanisms, and earth processes. Illustrations have been prepared to depict these processes. Like the written CSMs, these illustrations are conceptual in nature and do not represent actual site conditions or processes effecting contaminant distribution.

3.1 Areas West of I-435

3.1.1 SWMU 7 – No. 1 Melt Shop Baghouse Dust Tank

3.1.1.1 SWMU Background

The No. 1 Melt Shop Baghouse Dust Tanks (SWMU 7) consisted of two former tanks used for temporary storage of emission control dust. The total storage capacity of the tanks was approximately 75 CY. Prior to their demolition in 1991, the tanks were cleaned by a remediation contractor, and emission control dust was removed from dust handling equipment. Only the foundations of the No. 1 Melt Shop remain. The original defined SWMU area was approximately 50 feet by 25 feet. During the RFI, SWMU 7 expanded in size west and south of the former tanks to approximately 2 acres. The area currently consists of slag fill and surface materials, abandoned railroad beds, and the building foundation for the No. 1 Melt Shop.

3.1.1.2 Contaminant Distribution

Over the course of investigations at the Facility, 204 soil samples have been collected at SWMU 7 and analyzed for cadmium and lead. Cadmium was detected in 163 of the 204 soil samples at concentrations ranging from 0.1 to 281 mg/kg. Lead was detected in each of the 204 soil samples at concentrations ranging from 10.5 to 14,300 mg/kg, with the highest concentrations typically occurring below 1 foot below ground surface (bgs). As presented in the CMS Report, concentrations of cadmium and lead exceeded media cleanup standards. These exceedances were collocated and sporadically located throughout the SWMU 7 area. Figure 3-1 presents the distribution of lead at SWMU 7.

3.1.1.3 Migration / Fate and Transportation Mechanisms

Mechanisms which have potential to influence the migration / fate and transportation of lead and cadmium at SWMU 7 may include the generation and transportation of fugitive dust, tacking surface soils outside the area of contamination, and storm water runoff. While contamination has potential to be transported vertically by the settlement of fines and/or dust though course grained materials, this is not anticipated to be a significant transport mechanism.

3.1.1.4 Potential Receptors

Potential receptors are defined as the human or ecological populations that may be exposed to chemicals in an exposure medium through one or more exposure routes. This is described as a complete exposure pathway and must have the following essential components: site-related chemical release to the environment; transport to and presence at an exposure point; the presence of a receptor at the exposure point; and an exposure route. The following is a discussion of human receptors for which potentially complete exposure pathways may exist currently or in the future, in the absence of remediation. Given the industrial nature of the area surrounding SWMU 7 and lack of habitat, ecological receptors were not evaluated for SWMU 7. Figure 3-2 identifies potential human receptors that are likely to be exposed to contaminants present at SWMU 7 if no IM is applied.

Potentially exposed human populations include those persons whose locations and activities create an opportunity for contact with impacted media. Three potential receptors were identified at SWMU 7, based on current use and potential future changes in conditions. The receptors were identified based on the assumption of implementation of an environmental covenant regarding land and groundwater use restrictions as part of the final remedy for the Facility (USEPA, 2014). Potential receptors and exposure pathways were evaluated to determine whether the pathways are complete, potentially complete, or unknown.

Exposure pathways for the identified receptors at SWMU 7 include the following:

- Future Indoor Worker – Current land use is expected to remain industrial in the future, and an environmental restrictive covenant is planned as part of the final remedy for the Facility (USEPA, 2014). This receptor could be exposed to SWMU 7 contamination through inhalation of impacted surface soil that may be present indoors in the form of dust.

- Current/Future Outdoor Worker – Since there are non-paved areas at SWMU 7, outdoor workers are expected to be present for maintenance. These workers may be exposed to impacted surface soil (ingestion, dermal contact, and inhalation of dust).

- Future Construction Worker – If future land use at SWMU 7 requires construction activities or if excavation is required for subsurface utility work, construction workers could be exposed to impacted surface soil (ingestion, dermal contact, and inhalation of dust) and subsurface soil (ingestion, dermal contact, and inhalation of dust).

3.1.2 SWMU 33 – Nail Mill Degreasing Area

3.1.2.1 SWMU Background

The Nail Mill Degreasing Area (SWMU 33) was used for the removal of residue during the production of nails. The degreasing operation was located in the northwest portion of the Nail Mill (Figure 1-2). The presence of chlorinated VOCs in the surrounding area was discovered and reported in 1991 while Armco was preparing for the closure and conversion of the mill into a warehouse. The nail mill was subsequently demolished and a wood block floor contaminated with trichloroethylene (TCE) was removed and properly disposed. The Nail Mill Degreasing Area (SWMU 33) currently consists of rubble over the concrete floor of the former building. The defined SWMU 33 area is approximately 2.5 acres in size. At present, the surface materials consist of slag, other aggregate, and the remnants of concrete building foundations. There is no surface soil, per se, at this location. Figure 3-3 presents the location of SWMU 33 and the groundwater monitoring well network.

3.1.2.2 Contaminant Distribution

Over the course of investigations at SWMU 33, soil samples were collected from 37 sampling locations at depths up to 20 feet bgs. All of the samples were analyzed for VOCs, and samples from one location were also analyzed for semivolatile organic compounds (SVOCs). The predominant fraction of VOCs detected in soil samples included constituents that are associated with chlorinated solvents. The most commonly detected VOCs included TCE and cis-1,2-dichloroethylene (cis-1,2-DCE). Vinyl chloride was sporadically detected. Results for both TCE and vinyl chloride exceeded media cleanup standards. Historical evaluations concluded that a source of chlorinated VOCs existed in soils under the former degreaser location. Soil concentrations decreased moving radially outward from the former degreaser. In addition, samples collected for synthetic precipitation leaching procedure (SPLP) analysis further indicated that the TCE present in soils near the former degreaser location have the potential to leach to groundwater and produce a groundwater concentration in excess of the MCL. Figure 3-4 presents TCE in SWMU 33 soil as determine through historical sampling efforts. A pilot study for remediation of soil near the former degreaser location was conducted in 2011 (BMcD, 2011).

Over the course of investigations at the Facility, groundwater samples were collected from direct-push sampling locations and monitoring wells. A direct-push groundwater investigation was initially conducted in 1997 and 1998 to define the nature and extent of VOCs in the surrounding area. The investigation included both on-site field screening for VOCs and off-site laboratory analysis. Based on this investigation, monitoring well clusters were installed. These clusters were typically completed with two wells, as follows: one well screened in the shallow unconfined saturated zone (approximately 10 to 20 feet bgs) and one screened just above bedrock in the semi-confined deep saturated zone (approximately 60 to 70 feet bgs). One intermediate depth well was also installed directly over the semi-confining layer of the shallow saturated zone. Chlorinated VOCs were detected in groundwater throughout the SWMU 33 area. TCE and related degradation products, cis-1,2-DCE and vinyl chloride, were the primary VOCs detected, and exceedances of the media cleanup standards were noted. Figures 3-5 and 3-6 present CSMs for shallow and deep groundwater at SWMU 33. As presented on Figures 3-5 and 3-6, the highest concentrations were located around the SWMU 33 former degreasing pit near Monitoring Wells 33MW2S, 33MW2 (intermediate), 33MW3 (deep), and decreased radially outward from this location. The horizontal extent of VOCs in the shallow saturated zone was defined by samples collected from the perimeter of the SWMU 33 area. The extent of VOCs in the deep saturated zone was less clearly defined to the north due to vinyl chloride detections in samples from perimeter Well 33MW10D. Nearest the former degreaser, VOCs appeared to have migrated from the shallow saturated zone to the deep saturated zone. The potential pathway for this migration was identified as Monitoring Well 33MW3, and this well has since been replaced with surface-cased Monitoring Well 33MW3R. The SWMU 33 monitoring well network is presented on Figure 3-3. Figure 3-3 also presented the SWMU 17 monitoring well network.

Additional monitoring well clusters were installed in the vicinity of SWMU 17, Wire Mill Rinsewater Neutraliztion Tank, in 2014 to determine if a secondary source of chlorinated VOCs was present in the area surrounding SWMU 33 (See Figure 3-3). The newly installed wells and wells associated with SWMU 33 were sampled for VOCs quarterly for a year. Data from these quarterly sampling events was consistent with the historical data. Based on the sampling results, a secondary source of chlorinated VOCs in groundwater is not present at SWMU 17, and the former degreaser at SWMU 33 appears to be the sole source of chlorinated VOCs in groundwater.

3.1.2.3 Migration / Fate and Transportation Mechanisms

This section presents an assessment of migration mechanisms that may have, and could continue to affect the fate and transportation of VOCs present at SWMU 33. Historical sampling indicates that the contamination present at SWMU 33 is the result of operations at the former degreaser locations where

TCE was used to remove grease from fabricated nails. During the course of operation, TCE is believed to have been released to the ground surface in unknown quantities and frequencies resulting in elevated soil concentrations. When present in soil TCE binds to organic materials, is retained in pore space in the aqueous stage, and enters the vapor stage within the soil pore space. As additional product is released to surface soils contamination can migrate vertically in the aqueous stage. In the vadose zone, migration of TCE is controlled by the vertical percolation of aqueous TCE, the migration of aqueous TCE along low permeability units that may be present, and the lateral and vertical dissipation of TCE in the vapor stage. The distance TCE can migrate in the vapor stage is a result of site-specific considerations including: the makeup of the materials present in the subsurface, the presence/absence of cracks in the soil or preferential migration pathways (e.g. sand seams), and subsurface obstructions (e.g. abandoned foundations). TCE may migrate in the aqueous stage until the released material fills the available pore space and/or forces retarding the migration of the aqueous TCE cannot be overcome (e.g. capillary pressure, affinity to bind to organics).

If released in high enough quantities, liquid TCE can reach groundwater where it is immersable, and sinks due to its relatively high density forming a dense non-aqueous phase liquid (DNAPL). When present as a DNAPL, TCE will dissolve into groundwater until equilibrium is reached between the groundwater occupying the pore space shared with the TCE and the DNAPL. Soil SPLP samples collected from SWMU 33 indicate TCE is present in vadose zone soils at concentrations high enough to result in the leaching of TCE to groundwater. It is expected that infiltrating water passing through contaminated soils delivers leached TCE to groundwater in the dissolved phase. Based on the concentration of TCE observed in shallow and deep groundwater, DNAPL is not expected to be present.

Once present in groundwater, the migration of TCE is dictated by site hydrogeology and is a function of groundwater migration. The length of the dissolved phase groundwater plume is determined by the overall mass of TCE present and the rate at which it enters groundwater, the rate of groundwater flow and TCE dispersion, and microbial processes that are capable of degrading TCE. Plume geometry becomes stable once the rate at which TCE enters groundwater is equal to the rate at which TCE is consumed or dispersed at the plume's downgradient edge.

3.1.2.4 Potential Receptors

Potential receptors are defined as human or ecological populations that may be exposed to chemicals in an exposure medium through one or more exposure routes. This is described as a complete exposure pathway and must have the following essential components: site-related chemical release to the environment; transport to and presence at an exposure point; the presence of a receptor at the exposure

point; and an exposure route. The following is a discussion of human receptors for which potentially complete exposure pathways may exist currently or in the future, in the absence of remediation. Given the industrial nature of the area surrounding SWMU 33 and lack of habitat, ecological receptors were not evaluated for SWMU 33. Figure 3-7 identifies potential human receptors that are likely to be exposed to contaminants present at SWMU 33 if no IM is applied.

Potentially exposed human populations include those persons whose locations and activities create an opportunity for contact with impacted media. Three potential receptors were identified at SWMU 33, based on current use and potential future changes in conditions. The receptors were identified based on the assumption of implementation of an environmental covenant regarding land and groundwater use restrictions as part of the final remedy for the Facility (USEPA, 2014). Potential receptors and exposure pathways were evaluated to determine whether the pathways are complete, potentially complete or unknown.

Exposure pathways for the identified receptors at SWMU 33 include the following:

- Future Indoor Worker – Current land use is expected to remain industrial in the future. This receptor could be exposed to SWMU 33 contamination through inhalation of impacted surface soil that may be present indoors in the form of dust and vapor intrusion through foundation cracks from subsurface soil and/or groundwater.

- Current/Future Outdoor Worker – Since there are non-paved areas at SWMU 33, outdoor workers are expected to be present for maintenance. These workers may be exposed to impacted surface soil (ingestion, dermal contact, and inhalation of dust) and through inhalation of outdoor vapors from soil and/or groundwater in non-paved areas.

- Future Construction Worker – If future land use at SWMU 33 requires construction activities or if excavation is required for subsurface utility work, construction workers could be exposed to impacted surface soil (ingestion, dermal contact, and inhalation of dust), to subsurface soil (ingestion, dermal contact, and inhalation of dust), and through inhalation of outdoor vapors from soil and/or groundwater. Due the shallow depth to groundwater at SWMU 33 (approximately 8 feet bgs), construction workers could be directly exposed to groundwater through dermal contact.

3.2 Areas East of I-435

3.2.1 SWMU 4 – 1987 Waste Pile

3.2.1.1 SWMU Background

The 1987 Waste Pile (SWMU 4) consisted of a pile of emission control dust that was discovered in 1987 near the Old Blue River "W" Landfill (SWMU 2) east of I-435. The estimated quantity of emission control dust (i.e., K061 dust) in the waste pile was 14,000 cubic yards. It is not known how long the pile was in existence. In 1988, the waste pile was transported off site for reclamation and manifested as emission control dust. The original defined SWMU area was approximately 1.5 acres in size; however, during the RFI, the soil contamination in the SWMU 4 area expanded in size to the west and south to encompass nearly 16 acres. As shown on Figure 3-8, the area currently consists of slag fill, abandoned railroad beds, and sparse vegetation.

3.2.1.2 Contaminant Distribution

As presented in the CMS report (BMcD, 2013a), constituents identified above the IMOs at SWMU 4 include cadmium and lead in soil. Cadmium and lead have been detected soil samples collected at SWMU 4 at concentrations ranging from 0.3 to 681 milligrams per kilogram (mg/kg) and 14.4 to 31,500 mg/kg, respectively. The majority of the cadmium and lead concentrations in excess of the media cleanup standards were in the 0 to 2 feet bgs soil interval. The extent of cadmium and lead contamination was well defined by samples collected around the perimeter of the sampling area as indicated on Figure 3-8. Given the distribution and depth of contamination, it is possible that aerial deposition of wind-born emissions dust and/or the tracking of dust from the waste pile to adjacent areas have contributed to the current distribution of cadmium and lead in SWMU 4 soils.

Groundwater sampling performed in the vicinity of SWMU 4 has included the collection of samples from 16 direct-push sampling locations and quarterly groundwater sampling performed at SWMU 2 monitoring wells located adjacent to SWMU 4. Dissolved lead was detected in four of the 16 direct-push groundwater samples for which it was analyzed. The results for three of the centrally-located direct-push samples exceeded the MCL. Dissolved cadmium was detected in one of the three direct-push groundwater samples for which it was analyzed, and the detection was below the MCL.

In 2012, six monitoring wells were installed around the perimeter of SWMU 2. Of these wells, Monitoring Well 2MW01 was installed between SWMU 4 and the Blue River, and monitoring well 2MW05 was installed in close proximity to the SWMU 4 boundary (Figure 3-9). Groundwater sampling

events were conducted in February 2012, August 2012, March 2013, and September 2013. Samples were analyzed for the following metals: hexavalent chromium, chromium (dissolved), cadmium (total and dissolved), and lead (total and dissolved). With the one exception, no constituents were detected in excess of media cleanup standards. The March 2013 total cadmium result from Monitoring Well 2MW02, located was 0.0052 milligrams per liter (mg/L), slightly above the MCL of 0.005 mg/L. Dissolved cadmium was not detected.

No other exceedances of media cleanup standards were noted in samples from the four events. Dissolved cadmium was only detected in the February 2012 sample from Monitoring Well 2MW01. Dissolved lead was detected in samples collected from Monitoring Wells 2MW01 and 2MW05 during least one event. The September 2013 groundwater sampling event was the last of the four planned groundwater sampling events at SWMUs 2 and 4. Since only one marginal media cleanup standard exceedance of one constituent was noted across the four groundwater sampling events, no further groundwater sampling was performed and no further corrective action activities for groundwater are planned at SWMU 4.

3.2.1.3 Migration / Fate and Transportation Mechanisms

Mechanisms which have potential to influence the migration / fate and transportation of lead and cadmium at SWMU 4 include the generation and transportation of fugitive dust, tracking surface soils outside the area of contamination, and storm water runoff. These transportation mechanisms have the potential to increase the horizontal extent of SWMU 4 if IMs are not applied, and may have contributed to the current distribution of lead and cadmium in at SWMU 4. While contamination has potential to be transported vertically by the settlement of fines through course-grained materials, this is not anticipated to be a significant transport mechanism based upon the investigation data. As presented above, sampling of the Monitoring Wells 2MW01, 2MW03, and 2MW05 (see Figure 3-9) indicates that cadmium and lead were not present in groundwater in the vicinity of SWMU 4 at concentrations above the MCL. As a result, migration of metals via groundwater transportation is not considered a potential fate and transportation mechanism for SWMU 4.

3.2.1.4 Potential Receptors

Potential receptors are defined as the human or ecological populations that may be exposed to chemicals in an exposure medium through one or more exposure routes. This is described as a complete exposure pathway and must have the following essential components: site-related chemical release to the environment; transport to and presence at an exposure point; the presence of a receptor at the exposure point; and an exposure route. The following is a discussion of human and ecological receptors for which potentially complete exposure pathways may exist currently or in the future, in the absence of

remediation. Based upon the collected soil and groundwater data, Figure 3-10 identifies potential human receptors and Figure 3-11 identifies potential ecological receptors that have the potential to be exposed to contaminants present at SWMU 4 if no IM is applied.

Potentially exposed human populations include those persons whose locations and activities create an opportunity for contact with impacted media. Three potential receptors were identified at SWMU 4, based on current use and potential future changes in conditions. The receptors were identified based on the assumption of implementation of an environmental covenant regarding land and groundwater use restrictions as part of the final remedy for the Facility (USEPA, 2014). Potential receptors and exposure pathways were evaluated to determine whether the pathways are complete, potentially complete or unknown.

Exposure pathways for the identified human receptors at SWMU 4 include the following:

- Future Indoor Worker – Current land use is expected to remain industrial in the future. This receptor could be exposed to SWMU 4 contamination through inhalation of impacted surface soil that may be present indoors in the form of dust.

- Current/Future Outdoor Worker – Since there are non-paved areas of SWMU 4, outdoor workers are expected to be present for maintenance. These workers may be exposed to impacted surface soil (ingestion, dermal contact, and inhalation of dust).

- Future Construction Worker – If future land use at SWMU 4 requires construction activities or if excavation is required for subsurface utility work, construction workers could be exposed to impacted surface soil (ingestion, dermal contact, and inhalation of dust) and subsurface soil (ingestion, dermal contact, and inhalation of dust). Due the depth to groundwater, construction workers are not anticipated to be directly exposed to groundwater.

Potentially exposed wildlife populations include those species that may occur at the site for all or a portion of their lives and have an opportunity to come in contact with impacted media. As a previously disturbed and minimally maintained area, opportunistic terrestrial vegetation and common invertebrates (earthworms and insects), small mammals, and song birds likely occur at SWMU 4 and may be considered potential ecological receptors. Additional potential ecological receptors include larger mammals and birds that have large home ranges and may temporarily occur at SWMU 4. Although no streams occur within SWMU 4, storm water runoff may pond in low-lying areas and provide a temporary aquatic habitat for benthic and aquatic species.

A total of 16 potential ecological receptors were identified that would likely occur at SWMU 4; however, the potentially completed and completed pathways that were identified in the preliminary ecological CSM (Figure 3-11) may be determined to be incomplete based on the conditions observed in the field or due to a lack of suitable potential receptor habitat. The 16 potential ecological receptors include the following:

- Soil Invertebrates
- Terrestrial Plants
- Aquatic Plants
- Aquatic Invertebrates
- Benthic Invertebrates
- Bats
- Short-tailed Shrew
- White-footed Mouse
- Meadow Vole
- Cottontail Rabbit
- Red Fox
- Raccoon
- White-tailed Deer
- Red-tailed Hawk
- Wild Turkey

3.2.2 AOC 8 – "Owl Gun Club" Shooting Park

3.2.2.1 AOC Background

AOC 8 was a clay pigeon shooting park known as the "Owl Gun Club" which was located south of the Old Blue River "W" Landfill (SWMU 2) and immediately north of Rock Creek. The specific dates of operation of the Owl Gun Club are unknown. From a review of aerial photos, the AOC first becomes visible in 1955 and is no longer visible in 1974. Prior to use of the shooting range, the area was used for agriculture. Stationing posts and two trap buildings are visible on a 1955 aerial photograph. The western trap building is no longer present by 1964. By 1974, all evidence of the shooting range has been removed. Because little information is available about the dates the gun club was active or the amount of activity at the club, it is not possible to estimate how much lead shot might be present. The original defined AOC area was approximately 2.5 acres in size. During the RFI, the AOC 8 area shifted primarily

to the north and encompassed approximately 2 acres. The area currently consists of brush and grasses. The location of AOC 8 is presented on Figure 1-2 and Figure 3-12.

3.2.2.2 Contaminant Distribution

The expected source of contamination at AOC 8 is the aerial deposition of lead shot to surface soils as a result of the shooting park's operation. Figure 3-12 presents the distribution of lead at AOC 8. As presented on Figure 3-12, elevated concentrations of lead were primarily noted in the 0 to 1 foot bgs soil interval, with sporadic elevated lead concentrations noted to 2 feet bgs or deeper.

3.2.2.3 Migration / Fate and Transportation Mechanisms

As presented above, lead at AOC 8 is expected to occur as lead shot pellets that have been deposited in the surface soils. As a result, migration of lead at this location is expected to be minimal, but may occur through the generation of fugitive dust, storm water runoff, and the placement of bulk soils removed from the area.

3.2.2.4 Potential Receptors

Potential receptors are defined as the human or ecological populations that may be exposed to chemicals in an exposure medium through one or more exposure routes. This is described as a complete exposure pathway and must have the following essential components: site-related chemical release to the environment; transport to and presence at an exposure point; the presence of a receptor at the exposure point; and an exposure route. The following is a discussion of human receptors for which potentially complete exposure pathways may exist currently or in the future, in the absence of remediation. Figure 3-13 identifies potential human receptors that are likely to be exposed to contaminants present at AOC 8 if no IM is applied.

Potentially exposed human populations include those persons whose locations and activities create an opportunity for contact with impacted media. Three potential receptors were identified at AOC 8, based on current use and potential future changes in conditions. The receptors were identified based on the assumption of implementation of an environmental covenant regarding land and groundwater use restrictions as part of the final remedy for the Facility (USEPA, 2014). Potential receptors and exposure pathways were evaluated to determine whether the pathways are complete, potentially complete or unknown.

Exposure pathways for the identified human receptors at AOC 8 include the following:

- Future Indoor Worker – Current land use is expected to remain industrial in the future. This receptor could be exposed to AOC 8 contamination through inhalation of impacted surface soil that may be present indoors in the form of dust.

- Current/Future Outdoor Worker – Since there are non-paved areas at AOC 8, outdoor workers are expected to be present for maintenance. These workers may be exposed to impacted surface soil (ingestion, dermal contact, and inhalation of dust).

- Future Construction Worker – If future land use at AOC 8 requires construction activities or if excavation is required for subsurface utility work, construction workers could be exposed to impacted surface soil (ingestion, dermal contact, and inhalation of dust) and subsurface soil (ingestion, dermal contact, and inhalation of dust).

Potentially exposed wildlife populations include those species that may occur at the site for all or a portion of their lives and have an opportunity to come in contact with impacted media. As a previously disturbed and minimally maintained area, opportunistic terrestrial vegetation and common invertebrates (earthworms and insects), small mammals, and song birds likely occur at AOC 8 and may be considered potential ecological receptors. Additional potential ecological receptors include larger mammals and birds that have large home ranges and may temporarily occur at AOC 8. Although no streams occur within AOC 8, storm water runoff may pond in low-lying areas and provide a temporary aquatic habitat for benthic and aquatic species.

A total of 16 potential ecological receptors were identified that would likely occur at AOC 8; however, the potentially completed and completed pathways that were identified in the preliminary ecological CSM (Figure 3-14) may be determined to be incomplete based on the conditions observed in the field or due to a lack of suitable potential receptor habitat. The 16 potential ecological receptors include the following:

- Soil Invertebrates
- Terrestrial Plants
- Aquatic Plants
- Aquatic Invertebrates
- Benthic Invertebrates
- Bats
- Short-tailed Shrew
- White-footed Mouse

- Meadow Vole
- Cottontail Rabbit
- Red Fox
- Raccoon
- White-tailed Deer
- Red-tailed Hawk
- Wild Turkey

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4.0 DESCRIPTION OF INTERIM MEASURES

This section presents a summary of the selected interim measures to be applied to SWMUs 4, 7, 33, and AOC 8. The IMs described below were presented and evaluated in the CMS in accordance with the *Corrective Measures Work Plan* (BMcD, 2012c). Per USEPA's request to pursue IMs at SWMUs 4, 7, 33, and AOC 8, the recommended Corrective Measure Alternative for each of the areas presented in the CMS Report (BMcD, 2013a) will be applied as the IM. A description of the IMs for each of the SWMUs and AOC 8 is presented below.

4.1 SWMU 4 and AOC 8

Corrective Measure Alternative 3, as presented in the CMS Report (BMcD, 2013a) will be applied as the IM for SWMU 4 and AOC 8. This IM includes the excavation of contaminated soil from SWMU 4 and AOC 8 for consolidation into a single disposal cell. The consolidation cell will be located within the footprint of SWMU 4 where contamination has been identified at the deepest sampling intervals. Figure 4-1 presents a schematic identifying the location of the disposal cell and excavation depths needed to remove contaminated soil from areas outside of the disposal cell footprint. Excavation depths were generated using the historic sampling results presented in Sections 3.1 and 3.3. Once filled, the disposal cell will be covered with a soil cap as described below. The cap will be vegetated with a fescue grass mixture and maintained as a closed waste disposal cell. The process options and remedial technologies included in this alternative are presented in the following text:

- Excavation and Consolidation – Contamination identified in SWMU 4 and AOC 8 consists of elevated metals in soil. While contamination is primarily shallow (less than approximately 3 feet bgs), elevated concentrations of lead has been identified as deep as 9 feet bgs in the northeastern portion of SWMU 4. The IM includes the physical removal of soils identified as contaminated through excavation of the impacted media. Excavated soils will be consolidated in the vicinity of the deepest soil contamination in an area comprising approximately 3 acres. Figure 4-1 presents the approximate extent of the waste consolidation cell, and excavation depths required to remove contaminated soil. Following the removal of contaminated soil, confirmation sampling will be performed to assess the nature of materials remaining in place.
- Cap Installation / Post-Closure Care – Once consolidated, a soil cap will be installed to reduce the mobility of impacted soil present in the consolidation cell and to prevent direct contact with the impacted soil. The cap will be composed of 2 feet of compacted soil seeded with a grass mixture appropriate for the regional climate. The cap will be installed in a manner that promotes precipitation runoff and does not allow water to pool on the cap surface. If needed, berms or

swales may be installed to prevent adjacent areas from draining onto the installed cap. This alternative assumes that continued cap inspection and maintenance will be performed throughout duration of the post-closure period (30 years). Post-closure care activities will include the following activities: annual cap inspection, mowing (performed two times a year), and routine maintenance. Maintenance activities include general cap repair and resurfacing and are anticipated to occur once every 10 years.

- Site Restoration – Following the completion of this remedy, the areas where soil has been removed will be graded to promote drainage and seeded with a grass mixture appropriate for the regional climate. If necessary, fill may be used to bring portions of the excavation to grade and/or promote drainage.
- Cap / Consolidation Cell Closure – Closure and post-closure documents will be prepared for the waste consolidation cell for submittal to USEPA and MDNR. These documents will be prepared during the IM implementation phase in accordance with MDNR's Technical Bulletin titled *Preparing Solid Waste Disposal Area Closure and Post-Closure Plans* (MDNR, 2006). Closure documents may include the following components:
  - Indication of the closure status of areas within the consolidation cell that have received waste
  - A description of the closure activities and schedule
  - A survey of the closed consolidation cell
  - An engineering design of the capping system
  - Post-closure documents will include the following components:
    - A description of activities necessary to maintain the integrity of the final closure components (e.g. soil cap)
    - The location where closure records will be kept during the post-closure period
    - Items to be included in five-year review documents
- Land Use Restrictions – Future land use restrictions will be achieved through the execution of a MoECA covenant as part of a Facility-wide remedy. Components of a MoECA covenant applicable to SWMU 4 and AOC 8 will be submitted to USEPA and MDNR as part of the IM Completion Report.

4.2 SWMU 7

While the CMS Report (BMcD, 2013a) did not present corrective action alternatives for SWMU 7, USEPA requested corrective measures evaluation for hot spots at SWMU 7 in a December 3, 2013 comment letter to the CMS Report (USEPA, 2013). In addition, the December 3, 2014 letter from USEPA requested that SWMU 7 be addressed through IMs at the same time as IM activities were being

completed at SWMU 4, AOC 8, and SWMU 33. The following text presents a description of the intended IM for SWMU 7.

This IM includes the excavation of contaminated soil at SWMU 7 for placement in the SWMU 4 consolidation cell described above. Land use restrictions are also included to prevent future residential land use. The following text presents remedial technologies and process options included in this IM:

- Excavation for Consolidation or Disposal – Areas exhibiting soil contamination will be addressed through source removal. This will include soils with lead at concentrations greater than the MCS for lead at SWMUs and AOCs west of I-435 (1,531mg/kg). Contaminated soils will be excavated and transported to SWMU 4 where they will be incorporated into the consolidation cell identified in Section 4.1. Figure 4-2 presents the distribution of lead in soil with anticipated excavation depths to address areas of known contamination. Materials removed from SWMU 7 will include soils with lead concentrations above the MCS of 1,531mg/kg.
- Cap Installation and Post-Closure Care – Installation and post-closure care requirements for the SWMU 4 consolidation cell are presented in Section 4.1.
- Site Restoration – Following the removal of impacted media, fill material will be placed in areas of excavation to match the surrounding grade. Fill material will be compacted as it is placed and seeded using a fescue grass mix, or other appropriate ground cover.
- Land Use Controls – Future land use restrictions will be achieved through the execution of a MoECA covenant as part of a Facility-wide remedy. Components of a MoECA covenant applicable to SWMU 7 will be submitted to USEPA and MDNR as part of the IM Completion Report.

4.3 SWMU 33

Corrective Measure Alternative 3, as presented in the CMS Report (BMcD, 2013a) will be applied as the IM for SWMU 33. This IM includes the use of site access controls, land and groundwater use restrictions, and soil excavation activities. Risks associated with contaminated materials will be addressed through the direct removal of subsurface soil and monitored natural attenuation (MNA) of groundwater.

The SWMU 33 IM includes the excavation of contaminated soil from SWMU 33 for transportation to an off-site disposal facility. Figure 4-3 presents the approximate limits of the soil source area requiring excavation. Based on typical shallow groundwater surface depths ranging from 6 to 12 feet bgs, the excavation depth within the source area will be limited to 10 feet bgs. The lateral excavation extent was

determined using the 2010 and historic soil sampling results presented in Section 3.1.2. The process options and remedial technologies included in this alternative are presented in the following text:

- Excavation and Disposal – Contamination identified for SWMU 33 includes elevated levels of chlorinated VOCs in soil. TCE has been identified in soil from depths of 2 to 10 feet bgs at concentrations above 5 mg/kg, which were associated with SPLP results in excess of the groundwater media cleanup standard. Alternative 3 includes the physical removal of soils identified as contaminated through excavation of the impacted media. Excavated media will be stockpiled at the time of removal and disposed of at an appropriate treatment, storage, or disposal facility. As the presence of TCE in the soil could be the result of release of a listed waste, soils removed from the most heavily impacted portion of the source area will be segregated and representative samples will be collected for TCLP analysis for VOCs to verify that the contaminated soils do not meet the criteria of a characteristic hazardous waste. In addition, soil samples will be collected for analysis of total VOCs. If the TCLP VOC results are less than criteria presented in 40 CFR 261.24 and total VOC results for each detected VOC are less than USEPA RSLs for industrial soil, a contained out determination will be requested from MDNR. For purposes of this evaluation, it was assumed that 25 percent of the materials would require off-site disposal as hazardous waste and 75 percent of materials would be disposed as non-hazardous special waste. Excavated soil stockpiles will be constructed to isolate stored contaminated material from the environment. Stockpiles will be covered by geomembrane cover free of holes or other damage to prevent precipitation from entering the stockpile. The cover material shall be extended over the stockpile and anchored to prevent it from being removed or damaged by wind. Excavated soils will be dewatered (as necessary) prior to loading and transport to an off-site disposal facility. Following the removal of contaminated soil, confirmation sampling will be performed to assess the nature of materials remaining in place.
- Site Restoration - Following the completion of this remedy, excavations will be backfilled with compacted clean fill to match the original surface conditions.
- Land Use Controls – Future land and groundwater use restrictions will be achieved through the execution of a MoECA covenant as part of a Facility-wide remedy. Components of a MoECA covenant applicable to SWMU 33 will be submitted to USEPA and MDNR as part of the IM Completion Report.
- Monitored Natural Attenuation – MNA will be required for the achievement of SWMU 33 groundwater cleanup objectives. An MNA program consisting of groundwater sampling,

analysis, data evaluation, and reporting will be implemented following completion of the source area soil remedy.

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5.0 PROJECT MANAGEMENT AND SCHEDULE

This section presents a summary of the project management structure and a draft schedule for completion of the project design and construction components.

5.1 Key Project Assignments

5.1.1 AK Steel

Pat Gallo will be the Project Manager for AK Steel. His responsibilities will include coordinating with the BMcD project manager with respects to Facility access, security, and work restrictions. Mr. Gallo also provides signature certification of documents submitted to USEPA and MDNR in accordance with Part II of the Permit.

5.1.2 Burns & McDonnell

Sharon Shelton will be the BMcD Project Manager. Her responsibilities will include project staffing and oversight of all field and office efforts as the AK Steel's representative.

5.1.3 USEPA

Bruce Morrison will be the Project Manager for USEPA. His responsibilities will include review of reports submitted and project direction, if requested.

5.2 Project Progression and Schedule

Representatives from USEPA, MDNR, AK Steel, and BMcD met on October 21, 2015 to develop a strategy and schedule for completing steps in the RCRA corrective action process at the Facility. This strategy and schedule was documented in a letter dated October 27, 2015 from Bruce Morrison , USEPA, to Pat Gallo, AK Steel. The following corrective action schedule was set for SWMU 4, SWMU 7, AOC 8, and SWMU 33:

Unit	Remedial Strategy	CMS Report Due Date	IM Work Plan Due Date	IM Design/Bid Package Due Date	IM Implementation Start Date	IM Implementation Completion Date
SWMU 33	**Soil** Excavate & Disposal **Groundwater** LTM	May 2016	December 21, 2015	2016	2016	2016

Unit	Remedial Strategy	CMS Report Due Date	IM Work Plan Due Date	IM Design/Bid Package Due Date	IM Implementation Start Date	IM Implementation Completion Date
SWMU 4	**Soil** Consolidation Cell at SWMU 4	May 2016	December 21, 2015	2017	2018	2018
SWMU 7	**Soil** Consolidation Cell at SWMU 4					
AOC 8	**Soil** Consolidation Cell at SWMU 4					

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6.0 DESIGN CRITERIA

This section is intended to specify performance requirements for the overall IMs (as described in Section 4.0 of this IM Work Plan) to be implemented at SWMUs 4, 7, 33, and AOC 8. The process and methods to complete the IMs are discussed in detail in Section 7.0 of this IM Work Plan. Performance requirements are intended to define the constraints of the work that are intended to deliver the desired project result; these are discussed in detail below. General earthwork, excavation and backfilling specifications are provided as Appendix A, and are intended to supplement the information provided in this section.

6.1 Target Media Cleanup Standards

As discussed in the CMS Report (BMcD, 2013a), numerical and non-numerical media cleanup standards were developed for each of the SWMUs and AOCs to be addressed by the IMs described within this Work Plan. The cleanup standards are derived from site-specific chemical, media, and future land use considerations. The numerical standards are provided on Tables 2-1 through 2-3. The IMs contained within were designed to meet these standards.

As previously stated, land use near the Facility is characterized and zoned as medium to heavy industrial use, and this designation has been in place for decades. It is the intention of AK Steel to establish a non-residential land use restriction, through application of a MoECA covenant to maintain the use of the Facility as an industrial property. In addition, groundwater use restrictions will be established where appropriate. Therefore, each IM contained within this IM Work Plan includes the establishment of non-residential land use restrictions and groundwater use restrictions. USEPA acknowledged the implementation of an environmental restrictive covenant as part of the Facility's final remedy in the December 3, 2014 request to initial IMs for SWMUs 4, 7, and 33 and AOC 8.

6.1.1 SWMU 4 and AOC 8

Cadmium and lead are the contaminants of concern in soil at SWMU 4 and AOC 8. The numerical media cleanup standards for cadmium and lead are the soil site-specific ecological PRGs of 5 mg/kg for cadmium and 140 mg/kg for lead.

6.1.2 SWMU 7

Cadmium and lead are the contaminants of concern in soil at SWMU 7. The numerical media cleanup standards are the USEPA industrial soil RSL for cadmium of 980 mg/kg and the site-specific PRG for lead of 1,531 mg/kg.

6.1.3 SWMU 33

Chlorinated VOCs are the contaminants of concern at SWMU 33. The numerical media cleanup standards for VOCs are the USEPA RSLs for industrial soil, which are provided on Table 2-1.

6.1.4 Non-Numerical Target Media Cleanup Levels

As part of the CMS, the following non-numerical CAOs, which apply to each SWMU and AOC, were also developed:

- Reduce and manage potential human health risks potentially associated with Facility-related constituents in soil, such that:
  - The excess lifetime cancer risk associated with chemical exposure is within the USEPA 1E-04 to 1E-06 (one in 10,000 to one in a million) risk management range.
  - The hazard index for risks associated with non-carcinogenic chemical exposures is less than or equal to one (≤ 1).
- Eliminate, reduce, or control potential adverse ecological impacts due to constituent concentrations in soil at AOC 8 and SWMU 4, which are east of I-435, while balancing adverse ecological impacts that may result from remediation activities as presented in the *Interim EPA Region 7 Green Cleanup Policy* (USEPA, 2009).
- Eliminate, reduce, or control the potential for migration of Facility-related constituents in soil to groundwater such that groundwater media cleanup standards are not exceeded.

6.1.5 Points of Compliance

Points of compliance are the site-specific locations at which the concentrations of individual constituents should meet the media cleanup standards. For surficial exposure scenarios (i.e., direct contact with soils or groundwater, inhalation of vapors, etc.), the point of compliance will be established within the SWMU or AOC boundary. Points of compliance for each SWMU and/or AOC are outlined on Table 2-4.

6.2 Product Details

Product details include requirements for borrow, backfill, and consolidation cell cap materials. These products are discussed in more detail in Section 7.0 and Appendix A.

6.2.1 SWMU 4 and AOC 8

IM activities at SWMU 4 and AOC 8 include excavation of impacted materials (as defined in Section 6.1) followed by consolidation of excavation materials within the boundaries of SWMU 4 (see Figure 4-1). Once the excavated materials have been consolidated, the disposal cell will be covered with a soil cap.

6.2.1.1 Excavation and Consolidation

Following the removal of impacted soils, excavations will be graded to support drainage and seeded with a grass mixture appropriate for the regional climate. Backfill will be used, as needed, to bring portions of the excavations completed outside of the consolidation up to the surrounding grade and to promote drainage. Backfill will be acquired from on-site borrow sources identified prior to work commencing. Materials suitable for use as backfill include:

- Material free of debris, roots, organic matter, and frozen matter; and free of stone having any dimension greater than 2 inches in areas requiring a high degree of compaction, including soil cover and subgrade, or 6 inches in other embankment and fill areas:

    a. Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands exclusive of clayey material:
        (1) Free-draining.
        (2) Materials for which impact compaction will not produce a well- defined, moisture-density relationship curve.
        (3) Maximum density by impact methods will generally be less than by vibratory methods.
        (4) For which generally less than 15percent by dry weight, of soil particles pass the 75 μm (No. 200) sieve.
    b. Cohesive materials include silts and clays generally exclusive of sands and gravel:
        (1) Materials for which impact compaction will produce a well-defined, moisture-density relationship curve.

- Materials unsuitable for use in embankment and fill include all material that contains debris, roots, organic matter, frozen matter, gravel, stone, or shale particles with any dimension greater than 2 inches in areas requiring a high degree of compaction or 6 inches in other embankment and fill areas, or other materials that are determined by Engineer to be too wet or otherwise unsuitable for providing a stable subgrade or stable foundation for structures.
- Backfill will be placed and compacted in accordance with Section 3120000 Part 3.02 D provided in Appendix A.

Prior to approval of fill material, chemical and geotechnical testing will be completed and compared to the standards defined in Section 6.1 and Appendix A.

6.2.1.2 Cap Installation/Post-Closure Care

Once consolidated, a soil cap will be installed to reduce the mobility of impacted soil present in the consolidation cell and to prevent direct contact with the impacted soil. The cap will be composed of 2 feet of compacted soil seeded with a grass mixture appropriate for the regional climate. Requirements for the cap material are detailed in Section 312000 Part 2.01 D and Section 312300 Part 2.01 H of Appendix A. It is assumed that the cap will be installed in a manner that promotes precipitation runoff and does not allow water to pool on the cap surface. If needed, berms or swales may be installed to prevent adjacent areas from draining onto the installed cap.

This alternative assumes that continued cap inspection and maintenance will be performed throughout the post-closure period (30 years). Post closure care requirements will be established through the preparation of post-closure documents. For the purposes of the IM Work Plan, it is assumed that post-closure care will include the following activities: annual cap inspection, mowing (performed two times a year), and routine maintenance. Maintenance activities include general cap repair and resurfacing and are anticipated to occur once every 10 years.

6.2.2 SWMU 7

IM activities at SWMU 7 include soil hot spot removal, consolidation of excavation materials within the consolidation cell at SWMU 4, backfilling, and seeding (see Figure 4-2). It should be noted that a small portion of the excavated materials (approximately 90 CY) may be disposed of off-site as non-hazardous.

6.2.2.1 Excavation, Consolidation, and Disposal

Requirements for excavation, consolidation, and backfill within SWMU 7 are the same as those detailed in Section 6.2.1.1.

6.2.2.2 Site Restoration

Once excavated materials are transported to SWMU 4 for consolidation or off-site for disposal, backfill will be placed to match the surrounding grade and promote drainage prior to seeding the affected areas with seed mixture appropriate for the region.

6.2.3 SWMU 33

IM activities at SWMU 33 include excavation of contaminated soil for transportation to an off-site disposal facility and MNA (see Figure 4-3).

6.2.3.1 Excavation and Disposal

Requirements for excavation are the same as those detailed in Section 6.2.1.1. It is anticipated that 75percent of the excavated materials from SWMU 33 will be able to disposed of off-site as non-hazardous per MDNR's contained in policy. The remaining 25percent of excavated materials will be disposed of as hazardous at an off-site facility.

6.2.3.2 Backfill

Backfill for remedial activities at SWMU 33 will be as specified in Section 312000 Parts 2.02 A and 3.03 A and Section 312300 Parts 2.01 F and 2.01 I of Appendix A. .

6.3 Permitting and Regulatory Involvement

IM activities will be completed under the regulatory framework provided in Section 1.3.3. The following permits/authorizations are anticipated to support the implementation of the IMs:

- Site Disturbance Permit(s) from the City of Kansas City, Missouri.
- Flood Plain Development Permit from the City of Kansas City, Missouri for installation of the SWMU 4 consolidation cell.
- IM activities to be completed within SWMU 33 will include request for a contained-out determination from MDNR based upon test results of excavated soil stockpiles.

7.0 DESIGN BASIS

This section provides the process and methods to complete the IMs for SWMUs 4, 7, and 33, and AOC 8, detailed in Section 4.0 of this Work Plan. The information provided within this Section is provided in addition to detail contained in the technical specifications provided as Appendix A.

7.1 Site Preparation

The following site preparation activities will be required:

- Utility locate
- Site security
- Excavation extent delineation and field marking
- Clearing and grubbing

7.1.1 Utility Locate

Prior to commencement of the work, a utility locate will be scheduled and completed. The excavation contractor will be responsible for locating and protecting all utilities. All known buried utility conduits will be located and marked prior to implementation of any of the site preparation or IM activities. Missouri One-Call will be notified to locate the utilities. The locations of conduits will be identified and marked by the company or department responsible for the conduit. Conduit markings will be painted on the ground surface using the standard colors specific to the utility. However, should the markings wear off or be destroyed during the IM; the appropriate utility company or department will be contacted to relocate the conduits. In addition to paint markings, conduits in areas that are not paved will also be identified with flags.

7.1.2 Site Security

Only authorized personnel will be allowed on the Site. Only Occupational Safety and Health Administration (OSHA)-trained personnel will be allowed within (proximate to) the excavation areas. The Site Manager will control site access. Access to the site is currently restricted through dedicated security personnel and security fencing.

7.1.3 Excavation Extent Delineation and Field Marking

Before excavation activities, the lateral extent of the planned excavation will be marked with flags using figures provided in this IM Work Plan (see Figures 4-1 through 4-3) and the aid of a geographic positioning system (GPS) units and/or a site survey.

7.1.4 Clearing and Grubbing

At SWMU 4 and AOC 8, approximately 21 acres will be cleared, grubbed, and prepared for excavation activities using standard clearing equipment. These activities will be completed as detailed in Section 312000 Parts 3.01 A, B, and C. The extent of clearing and grubbing in these areas will be limited to the planned excavation areas (see Figure 4-1). In the event large root masses are removed during excavation, they will be mulched or ground prior to placement within the consolidation cell. Care will be taken to protect the tops, trunks, and roots of existing trees that are to remain on site.

Clearing and grubbing activities are not anticipated at SWMUs 7 and 33.

7.2 Borrow Material Acquisition and Stockpiling

Based upon the anticipated excavation extents (see Figures 4-1 through 4-3), the following amounts and types of borrow material are required:

- SWMU 4 and AOC 8 – 10,163 CY
- SWMU 7 – 1,250 CY
- SWMU 33 – 3,593 CY

Material suitable as borrow for backfill, as specified in Sections 312000 Part 2.01 A, 3.02 C, 3.05 and 312300 Part 2.01 D and I, will be collected from on-site sources identified by Burns & McDonnell and the excavation contractor prior to the start of excavation activities. Two to four weeks of lead time will be required to adequately test identified borrow areas for compliance with project requirements as detailed in the technical specifications provided as Appendix A. It is assumed that an acceptable borrow source(s) will be identified on site, and that off-site borrow material will not be required.

Backfill material acquired from approved on-site borrow sources will be stockpiled near the anticipated excavations in the quantities prescribed within this section and Section 312000 Part 3.02 B.5 of Appendix A. The excavation contractor will take the precautions necessary to limit erosion of the piles prior to placement (i.e., covers, silt fencing, promoting vegetation, etc.).

7.3 Excavation

The sequence of the IMs for each area (SWMU 4 and AOC 8, SWMU 7, and SWMU 33) will generally be as follows. The final sequencing and schedule will be determined by the excavation contractor selected to implement the IMs.

1. Obtain all required permits;

2. Community relations;
3. Mobilization;
4. Identify and locate utilities;
5. Delineate excavation areas;
6. Clearing and grubbing;
7. Excavation, loading and transport;
8. Confirmation sampling and laboratory analysis;
9. Waste material consolidation;
10. Backfill;
11. Soil cap construction (SWMU 4)
12. Site Restoration; and
13. Demobilization.

7.3.1 SWMU 4 and AOC 8

The proposed excavation areas are identified on Figure 4-1. Excavation depths vary across the planned excavation area as illustrated on Figure 4-1, but in general vary from one to six feet bgs. Excavation activities will be conducted with trackhoe equipment. When practicable, excavated material will be directly loaded into trucks for subsequent stockpiling near the consolidation cell located within SWMU 4. If stockpiling of excavated soil is necessary, soil will be placed within the area of contamination or on an impermeable liner and covered with poly sheeting to prevent odor or dust impacts. Excavation activities to be completed at SWMU 4 and AOC 8 encompass approximately 35 acres and are expected to generate 18,080 CY of material. Excavation activities will be completed using the methods detailed in Section 312000 Part 3.02 B and Section 312300 Part 3.01 of Appendix A.

Although it is not anticipated based on historical groundwater levels and planned excavation depths, a dewatering plan will be developed, if determined that dewatering is necessary.

Confirmation samples will be collected to document the nature of materials remaining in place as detailed in Section 7.4.

7.3.2 SWMU 7

The proposed excavation areas are identified on Figure 4-2. Excavation depths vary across the planned excavation area as illustrated on Figure 4-2, but in general vary from zero to eight feet bgs. Excavation activities will be conducted with trackhoe equipment. When practicable, excavated material will be directly loaded into trucks for subsequent stockpiling near the consolidation cell located within SWMU 4.

If stockpiling of excavated soil is necessary, soil will be placed within the area of contamination or on an impermeable liner and covered with poly sheeting to prevent odor or dust impacts. Excavation activities to be completed at SWMU 7 are expected to generate 1,250 CY of material. Excavation activities will be completed using the methods detailed in Section 312000 Part 3.02 B and Section 312300 Part 3.01 of Appendix A.

Although it is not anticipated based on historical groundwater levels and planned excavation depths, a dewatering plan will be developed, if determined that dewatering is necessary.

7.3.3 SWMU 33

The proposed excavation areas are identified on Figure 4-3. The planned excavation depth is 10 feet bgs across the entire lateral footprint illustrated on Figure 4-3. Excavation activities will be conducted with trackhoe equipment. When practicable, excavated material will be directly loaded into trucks for subsequent disposal off-site. Soil will be transported and disposed of as non-hazardous (pending a contained-out determination) at an approved Subtitle D landfill. Each truck hauling solid waste will be weighed at the disposal facility. The disposal facility will submit daily tonnage totals to the oversight contractor. All trucks leaving the Facility will have appropriate manifests or bill of lading and will be inspected prior to departing the Facility and all loads will be covered. The excavation contractor will be responsible for inspecting and cleaning truck tires before trucks leave the Facility. A dry decon area will be constructed upon which the wheels of vehicles may be scraped clean. Streets will be swept and cleaned as necessary during the hauling process. If stockpiling of excavated soil is necessary, soil will be placed on an impermeable liner and covered with poly sheeting to prevent odor or dust impacts. Excavation activities to be completed at SWMU 33 are expected to generate 3,593 CY of material. Excavation activities will be completed using the methods detailed in Section 312000 Part 3.02 B and Section 312300 Part 3.01 of Appendix A.

Although it is not anticipated based on historical groundwater levels and planned excavation depths, a dewatering plan will be developed, if determined that dewatering is necessary.

7.4 Confirmation Sampling

Confirmation samples will be collected as detailed in Section 312000 Part 3.05 E. Confirmation samples will be collected at a frequency of one per 900 square feet of excavation and analyzed for the following:

- SWMU 4 and AOC 8 – cadmium and lead via USEPA SW-846 Method 6010
- SWMU 7 – cadmium and lead via USEPA SW-846 Method 6010
- SWMU 33 – VOCs via USEPA SW-846 Method 8260

Confirmation samples will be collected to document the nature of materials remaining in place. Analytical data will be compared to the target media cleanup standards discussed in Section 6.1 of this IM Work Plan.

7.5 Consolidation Material Transport and Placement

Consolidation material (contaminated soil planned for excavation) from SWMU 4 and AOC 8 and SWMU 7 will be placed via dump truck and trackhoe into the consolidation cell planned to be constructed within SWMU 4. Material requirements were discussed in Section 6.2.1.1. Methods for placement are specified in Section 312000 Parts3.02 A.

7.6 Backfilling and Site Restoration

Backfill material for areas outside of the consolidation cell at SWMU 4 and AOC 8 and for excavations performed at SWMU 7 and 33 will be placed and compacted in accordance with Section 312000 Parts 3.02 C and 3.03 A. Following the excavation and disposal of impacted materials, backfilling will commence using clean soil imported from an on-site source. Backfill material will be free of chemical contamination above the target media cleanup standards based on characterization sample results. A characterization sample will be collected from the backfill material as described in Section 7.2. Placement and compaction of backfill will be conducted at the direction of the oversight contractor until original grade is reached. Backfill will be placed and compacted in 8-inch lifts and compacted to at least 95 percent of the maximum dry density as determined by the American Society for Testing and Materials (ASTM) Method D-698. Compaction will be performed using a sheeps foot compactor or equivalent. Compaction tests shall be performed using ASTM Methods D-1556, D-2167 or D-6938. A minimum of one test per 250 cubic yards or one test per 2,500 square feet per lift of fill material shall be made to assess compaction. Soil moisture content shall be within 3 percent of the optimum soil water content. The Site will be returned to near original grade. The final four inches of fill to be placed at SWMU 33 will consist of granular aggregate as specified in Section 312300 Part 2.01 F. Disturbed areas will be seeded and straw will be placed over the seeded area. The areas where soil has been removed will be graded to promote drainage and seeded with a grass mixture appropriate for the regional climate.

7.7 Soil Cap and Vegetative Cover at SWMU 4

As detailed in Section 4 of this IM Work Plan, once filled, the consolidation cell will be covered with a soil cap vegetated with a grass mixture selected for the climate and maintained as a closed waste disposal cell. Details for post-closure care of the soil cap are provided in Section 7.13 of this IM Work Plan.

Prior to commencement of IM activities, potential on-site borrow areas will be identified and geotechnical samples will be collect to confirm the appropriateness of the material to be used as a soil cap. Requirements for the soil cap to be constructed over the consolidation cell within SWMU 4 are provided in Section 6.2.1.2 of this IM Work Plan and Appendix A.

Once a suitable soil cap material is located, it will be transported and stockpiled near the consolidation cell using the same methods and equipment detailed in Sections 7.5 and 7.6 of this IM Work Plan. Once the waste materials from IM activities have been placed within the consolidation cell, the soil cap will be constructed with a thickness of no less than two feet. Placement and compaction of backfill will be completed as detailed in Section 312000 Part 3.02 F.

Once the soil cap is constructed, a vegetative soil layer will be placed and seeded with a grass mixture appropriate for the regional climate. The vegetative soil layer will be distributed over the required area without compaction, other than nominal compaction obtained with low ground pressure spreading equipment (see Section 312000 Part 3.02 G).

7.8 Storm Water Control

To minimize infiltration of storm-water and runoff of potentially impacted water and silt to surrounding areas, best management practices will be employed. Open excavations will be either bermed or surrounded with straw bales or wattles to minimize potential infiltration of storm-water. Prior to expected storm events, open excavations may be covered with plastic sheeting or tarpaulin to the extent practical. Water that may collect within the excavation and interfere with removal activities may be pumped to a holding tank for subsequent management. Straw bales, straw wattles (logs) and/or silt fences will be used to prevent silt from entering storm-water inlets. If straw bales are used, they will be wrapped with Mirafi® Nonwoven 140NL Geotextile or equivalent. Additional controls may be installed if site conditions warrant or if excavation areas expand beyond their planned areas. The excavation contractor will procure all necessary permits.

7.9 Air Monitoring

An air monitoring program will be implemented during removal activities at the Facility to mitigate air emissions associated with the removal activities that might cause adverse health effects. The air-monitoring program will be described in detail in an Ambient Air Monitoring Plan (AAMP) which will be a stand-alone document prepared by the oversight contractor. The air-monitoring program will consist of real-time ambient air monitoring and collection of time-averaged ambient air samples. The objective of real-time ambient air monitoring is to collect ambient air concentration data that can be used to

maintain safe conditions for the surrounding community during removal activities. The objective of the time-averaged air sampling is to obtain data to evaluate the effectiveness of the real-time monitoring program. Real-time ambient air monitoring will be used to evaluate daily ambient air concentrations and to implement, as necessary, precautionary activities needed to prevent and mitigate short-term ambient air impacts due to removal activities. Procedures for worker safety and health monitoring will described in the project HSP to be developed prior to implementation of the IM activities.

7.10 Site Survey

Upon completion of IM activities, a survey of the consolidation cell soil cap will be completed by a Licensed Professional Land Surveyor in the State of Missouri. The survey will be conducted as specified in Section 312000 Part 3.05 F.2.

7.11 Institutional and Land Use Controls

Future land use restrictions will be achieved through the execution of a MoECA covenant, which is anticipated when the final remedy is established for the Facility.

7.11.1 SWMU 4 and AOC 8

Portions of the MoECA document applicable to the consolidation cell include: No Disturbance of Soil, Construction Worker Notice, Engineered Controls for Soil, and Construction Restrictions. If not included as part of a Facility-wide corrective measure, the No Residential Land Use restriction will be applied to entirety of the SWMU 4 and AOC 8.

7.11.2 SWMU 7

If not included as part of a Facility-wide corrective measure, the No Residential Land Use restriction will be applied to entirety of the SWMU 7.

7.11.3 SWMU 33

Institutional controls to be applied at SWMU 33 are intended to prevent future land use activities likely to result in unacceptable exposures to impacted groundwater or marginally impacted soil that may remain in place following excavation activities. Portions of the MoECA document to be applied to SWMU 33 include the No Disturbance of Soil, No Drilling or Use of Groundwater (for drinking water or industrial purposes), No Construction Worker Exposure to Groundwater, and the related Construction Worker Notices.

7.12 Post-Closure Care

A description of planned activities post remedy is provided below.

7.12.1 SWMU 4 and AOC 8

At SWMU 4 and AOC 8, it is anticipated that cap maintenance, mowing, and five-year reviews will be required for a period of 30 years. Cap maintenance (replacing soil cover or other erosional issues) is anticipated to be completed once every 10 years or as necessary to achieve project goals. The cap will be mowed twice yearly during the growing season.

A more detailed Post-Closure Plan will be developed for SWMU 4 and AOC 8 and submitted to USEPA and MDNR for review and approval within 30 days of completion of excavation, consolidation, and/or backfilling activities.

7.13 SWMU 33

MNA will be required for the achievement of SWMU 33 groundwater cleanup objectives. An MNA program consisting of groundwater sampling, analysis, data evaluation, and reporting will be implemented following completion of the source area soil remedy. Wells will be sampled at the following frequency:

Years	Number of Wells*	Sampling Frequency	Sample Type
0-5	25	Semi-annual	MNA
6-10	19	Annual	MNA
11-30	13	Annual	LTM

* – Number of wells sampled will be reflective of MNA results and stability/reduction of plume size.

It is anticipated that the MNA program will be implemented for a period of 10 years, at which time the program will be moved in to long term monitoring for the remained of the post-closure period (30 years). The effectiveness of the MNA program will be evaluated with respect to the groundwater MCSs. Additional remedies may be considered for groundwater if the MNA sampling program indicates that contaminant concentrations in groundwater are not decreasing at an acceptable rate.

A more detailed work plan for the MNA program will be developed and submitted to the USEPA and MDNR for review and approval within 90 days of the completion of backfill placement at SWMU 33.

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* * * * *

TABLES

Table 2-1
Media Cleanup Standards for Non-Residential Soil
SWMUs and AOCs West of I-435

IM Work Plan

AK Steel Kansas City Facility

Parameter	Units	Non-Residential Soil MCS West I-435		
INORGANICS				
Arsenic, Total	mg/kg	24		BVBG
Barium, Total	mg/kg	220,000		Ind RSL
Cadmium, Total	mg/kg	980		Ind RSL
Chromium, Total	mg/kg	1,800,000	a	Ind RSL
Chromium, Trivalent	mg/kg	1,800,000		Ind RSL
Lead, Total	mg/kg	1,531		Site PRG
Mercury, Total	mg/kg	350	b	Ind RSL
Mercury, Elemental	mg/kg	40	c	Ind RSL
Selenium, Total	mg/kg	5,800		Ind RSL
Silver, Total	mg/kg	5,800		Ind RSL
VOLATILE ORGANIC COMPOUNDS				
1,1,1-Trichloroethane	mg/kg	36,000		Ind RSL
1,1,2-Trichloroethane	mg/kg	5		Ind RSL
1,1-Dichloroethane	mg/kg	16		Ind RSL
1,1-Dichloroethene	mg/kg	1,000		Ind RSL
1,2-Dichloroethane	mg/kg	2		Ind RSL
1,2,4-Trichlorobenzene	mg/kg	110		Ind RSL
2-Butanone	mg/kg	190,000		Ind RSL
2-Hexanone	mg/kg	1,300		Ind RSL
4-Methyl-2-pentanone	mg/kg	56,000		Ind RSL
Acetone	mg/kg	670,000		Ind RSL
Benzene	mg/kg	5.1		Ind RSL
Carbon disulfide	mg/kg	3,500		Ind RSL
Chlorobenzene	mg/kg	1,300		Ind RSL
Chloroform	mg/kg	1.4		Ind RSL
cis-1,2-Dichloroethene	mg/kg	2,300		Ind RSL
Ethylbenzene	mg/kg	25		Ind RSL
Methylene chloride	mg/kg	1,000		Ind RSL
Styrene	mg/kg	35,000		Ind RSL
Tetrachloroethene	mg/kg	100		Ind RSL
Toluene	mg/kg	47,000		Ind RSL
trans-1,2-Dichloroethene	mg/kg	23,000		Ind RSL
Trichloroethene	mg/kg	6		Ind RSL
Vinyl chloride	mg/kg	1.7		Ind RSL
Xylene, m,p-	mg/kg	2,400		Ind RSL
Xylene, o-	mg/kg	2,800		Ind RSL
Xylenes, Total	mg/kg	2,800		Ind RSL
SEMIVOLATILE ORGANIC COMPOUNDS				
1-Methylnaphthalene	mg/kg	73		Ind RSL
2,4-Dimethylphenol	mg/kg	18,000		Ind RSL
2-Methylnaphthalene	mg/kg	3,000		Ind RSL
4-Methylphenol	mg/kg	82,000		Ind RSL
Acenaphthene	mg/kg	45,000		Ind RSL
Acenaphthylene	mg/kg		--	
Anthracene	mg/kg	230,000		Ind RSL
Benzo(a)anthracene	mg/kg	2.9		Ind RSL
Benzo(a)pyrene	mg/kg	0.386		BVBG
Benzo(b)fluoranthene	mg/kg	2.9		Ind RSL
Benzo(g,h,i)perylene	mg/kg		--	
Benzo(k)fluoranthene	mg/kg	29		Ind RSL

Table 2-1
Media Cleanup Standards for Non-Residential Soil
SWMUs and AOCs West of I-435

IM Work Plan

AK Steel Kansas City Facility

Parameter	Units	Non-Residential Soil MCS West I-435	
SEMIVOLATILE ORGANIC COMPOUNDS			
Bis(2-ethylhexyl)phthalate	mg/kg	160	Ind RSL
Butylbenzylphthalate	mg/kg	1,200	Ind RSL
Chrysene	mg/kg	290	Ind RSL
Dibenzo(a,h)anthracene	mg/kg	0.29	Ind RSL
Dibenzofuran	mg/kg	1,000	Ind RSL
Dimethyl phthalate	mg/kg	120,000	Ind RSL
Di-n-butylphthalate	mg/kg	82,000	Ind RSL
Fluoranthene	mg/kg	30,000	Ind RSL
Fluorene	mg/kg	30,000	Ind RSL
Indeno(1,2,3-cd)pyrene	mg/kg	2.9	Ind RSL
Naphthalene	mg/kg	17	Ind RSL
Phenanthrene	mg/kg	--	
Phenol	mg/kg	250,000	Ind RSL
Pyrene	mg/kg	23,000	Ind RSL
TOTAL PETROLEUM HYDROCARBONS			
Diesel	mg/kg	--	
Gasoline Range Organics (C6-C10)	mg/kg	--	
Motor Oil	mg/kg	--	
TPH (extractable)	mg/kg	--	
TPH (volatile)	mg/kg	--	

Media cleanup standards are presented for constituents that have been detected in soil samples collected from SWMUs and AOCs west of I-435 (i.e., SWMUs 6, 7, 13, 17, 24, and 33, and AOCs 1 and 4). Media cleanup standards are not presented for constituents that were analyzed but not detected.

mg/kg - millgrams per kilogram

MCS - media cleanup standard

a - Hexavalent chromium has not been detected in soil at the Facility. Therefore, the screening level for trivalent chromium was used for total chromium.

b - Value is for mercuric chloride and mercury salts.

c - The elemental mercury screening level will only be used for screening in locations where the historical presence of mercury switches and gauges is known.

d - m-Xylene and p-Xylene could not be differentiated by lab. The lower screening level for m-xylene was used.

BVBG - Blue Valley Industrial Corridor Soils Background Study Report, Brownfields Showcase Project (USACE, 2003)

Ind RSL - Industrial Soil Regional Screening Level Summary Table (USEPA, 2015)

Site-Specific PRG - Site-specific preliminary remediation goal for lead (USEPA, 2010)

TPH - Total Petroleum Hydrocarbons

Table 2-2
Media Cleanup Standards for Ecological/Non-Residential Soil
SWMUs and AOCs East of I-435

IM Work Plan

AK Steel Kansas City Facility

Parameter	Units	Ecological/Non-Residential Soil MCS East I-435		
INORGANICS				
Cadmium, Total	mg/kg	5.0		Site Eco PRG
Chromium, Total	mg/kg	38.8		BVBG
Chromium, Trivalent	mg/kg	38.8	a	BVBG
Lead, Total	mg/kg	140		Site Eco PRG
VOLATILE ORGANIC COMPOUNDS				
1,1,1-Trichloroethane	mg/kg	29.8		R5 Eco
2-Butanone	mg/kg	89.6		R5 Eco
Acetone	mg/kg	2.5		R5 Eco
Benzene	mg/kg	0.255		R5 Eco
Carbon disulfide	mg/kg	0.0941		R5 Eco
Chlorobenzene	mg/kg	13.1		R5 Eco
Ethylbenzene	mg/kg	5.16		R5 Eco
Methylene chloride	mg/kg	4.05		R5 Eco
Styrene	mg/kg	4.69		R5 Eco
Tetrachloroethene	mg/kg	9.92		R5 Eco
Toluene	mg/kg	5.45		R5 Eco
Xylene, m,p-	mg/kg	10	b	R5 Eco
Xylene, o-	mg/kg	10	b	R5 Eco
Xylenes, Total	mg/kg	10		R5 Eco
SEMIVOLATILE ORGANIC COMPOUNDS				
2-Methylnaphthalene	mg/kg	3.24		R5 Eco
Anthracene	mg/kg	1480		R5 Eco
Benzo(a)anthracene	mg/kg	2.9		Ind RSL
Benzo(a)pyrene	mg/kg	0.386		BVBG
Benzo(b)fluoranthene	mg/kg	2.9		Ind RSL
Benzo(g,h,i)perylene	mg/kg	119		R5 Eco
Benzo(k)fluoranthene	mg/kg	29		Ind RSL
Chrysene	mg/kg	4.73		R5 Eco
Dibenzo(a,h)anthracene	mg/kg	0.29		Ind RSL
Dibenzofuran	mg/kg	1,000		Ind RSL
Fluoranthene	mg/kg	122		R5 Eco
Indeno(1,2,3-cd)pyrene	mg/kg	2.9		Ind RSL
Naphthalene	mg/kg	0.0994		R5 Eco
Phenanthrene	mg/kg	45.7		R5 Eco
Pyrene	mg/kg	78.5		R5 Eco

Table 2-2
Media Cleanup Standards for Ecological/Non-Residential Soil
SWMUs and AOCs East of I-435

IM Work Plan

AK Steel Kansas City Facility

Parameter	Units	Ecological/Non-Residential Soil MCS East I-435
TOTAL PETROLEUM HYDROCARBONS		
TPH (extractable)	mg/kg	--
TPH (volatile)	mg/kg	--

Media cleanup standards are presented for constituents that have been detected in soil samples collected from SWMUs and AOCs east of I-435 (i.e., SWMU 4, SWMU 12, and AOC 8). Media cleanup standards are not presented for constituents that were analyzed but not detected.

mg/kg - millgrams per kilogram
MCS - media cleanup standard
a - BVBG value for total chromium was applied to trivalent chromium.
b - The Region 5 Ecological screening level for total xylenes was applied to m,p-xylene and o-xylene.

BVBG - Blue Valley Industrial Corridor Soils Background Study Report, Brownfields Showcase Project (USACE, 2003)
Ind RSL - Industrial Soil Regional Screening Level Summary Table (USEPA, 2015)
R5 Eco - USEPA Region 5, RCRA, Ecological Screening Levels (USEPA, 2003)
Site Eco PRG - Site-specific ecological preliminary remedation goal (USEPA, 2012a)
TPH - Total Petroleum Hydrocarbons

Table 2-3
Media Cleanup Standards for Groundwater
IM Work Plan
AK Steel Kansas City Facility

Parameter	Units	Groundwater MCS		
INORGANICS				
Arsenic	µg/L	10		MCL
Barium	µg/L	2,000		MCL
Cadmium	µg/L	5		MCL
Chromium, Trivalent	µg/L	22,000		RSL
Chromium, Total	µg/L	100		MCL
Lead	µg/L	15		MCL
Mercury	µg/L	2		MCL
Selenium	µg/L	50		MCL
Silver	µg/L	94		RSL
VOLATILE ORGANIC COMPOUNDS				
1,1,1-Trichloroethane	µg/L	200		MCL
1,1,2-Trichloroethane	µg/L	5		MCL
1,1-Dichloroethane	µg/L	2.7		RSL
1,1-Dichloroethene	µg/L	7		MCL
1,2-Dichloroethane	µg/L	5		MCL
1,2-Dichloroethene	µg/L	70	a	MCL
1,2-Dichloropropane	µg/L	5		MCL
4-Methyl-2-pentanone	µg/L	1,200		RSL
Acetone	µg/L	12,000		RSL
Benzene	µg/L	5		MCL
Carbon disulfide	µg/L	810		RSL
Carbon tetrachloride	µg/L	5		MCL
Chloroform	µg/L	80	b	MCL
cis-1,2-Dichloroethene	µg/L	70		MCL
Ethylbenzene	µg/L	700		MCL
Methylene chloride	µg/L	5		MCL
Tetrachloroethene	µg/L	5		MCL
Toluene	µg/L	1,000		MCL
trans-1,2-Dichloroethene	µg/L	100		MCL
Trichloroethene	µg/L	5		MCL
Vinyl acetate	µg/L	410		RSL
Vinyl chloride	µg/L	2		MCL
Xylene, m,p-	µg/L	190		RSL
Xylene, o-	µg/L	190		RSL
Xylenes, Total	µg/L	10,000		MCL
SEMIVOLATILE ORGANIC COMPOUNDS				
2,4-Dimethylphenol	µg/L	360		RSL
2-Methylphenol	µg/L	930		RSL
4-Chloroaniline	µg/L	0.36		RSL
4-Methylphenol	µg/L	1,900		RSL
Benzo(a)pyrene	µg/L	0.2		MCL
Benzo(b)fluoranthene	µg/L	0.034		RSL
Benzo(k)fluoranthene	µg/L	0.34		RSL
Bis(2-ethylhexyl)phthalate	µg/L	6		MCL
Chrysene	µg/L	3.4		RSL
Fluoranthene	µg/L	800		RSL
Isophorone	µg/L	78		RSL
Naphthalene	µg/L	0.17		RSL
Phenanthrene	µg/L	--		
Phenol	µg/L	5,800		RSL
Pyrene	µg/L	120		RSL
TOTAL PETROLEUM HYDROCARBONS				
TPH (extractable)	µg/L	--		
TPH (volatile)	µg/L	--		

Table 2-3
Media Cleanup Standards for Groundwater
IM Work Plan
AK Steel Kansas City Facility

Parameter	Units	Groundwater MCS	
WATER QUALITY PARAMETERS			
Chloride	µg/L	--	
Nitrate as Nitrogen	µg/L	10,000	MCL
Nitrite as Nitrogen	µg/L	1,000	MCL
Sulfate	µg/L	--	
Total Organic Carbon	µg/L	--	

Media cleanup standards are presented for constituents that have been detected in groundwater samples collected at the Facility. Media cleanup standards are not presented for constituents that were analyzed but not detected.

µg/L - micrograms per liter

a - Value is for total 1,2-cis-dichloroethylene.
b - Value is for total trihalomethanes: bromodichloromethane, bromoform, chloroform, and dibromochloromethane.

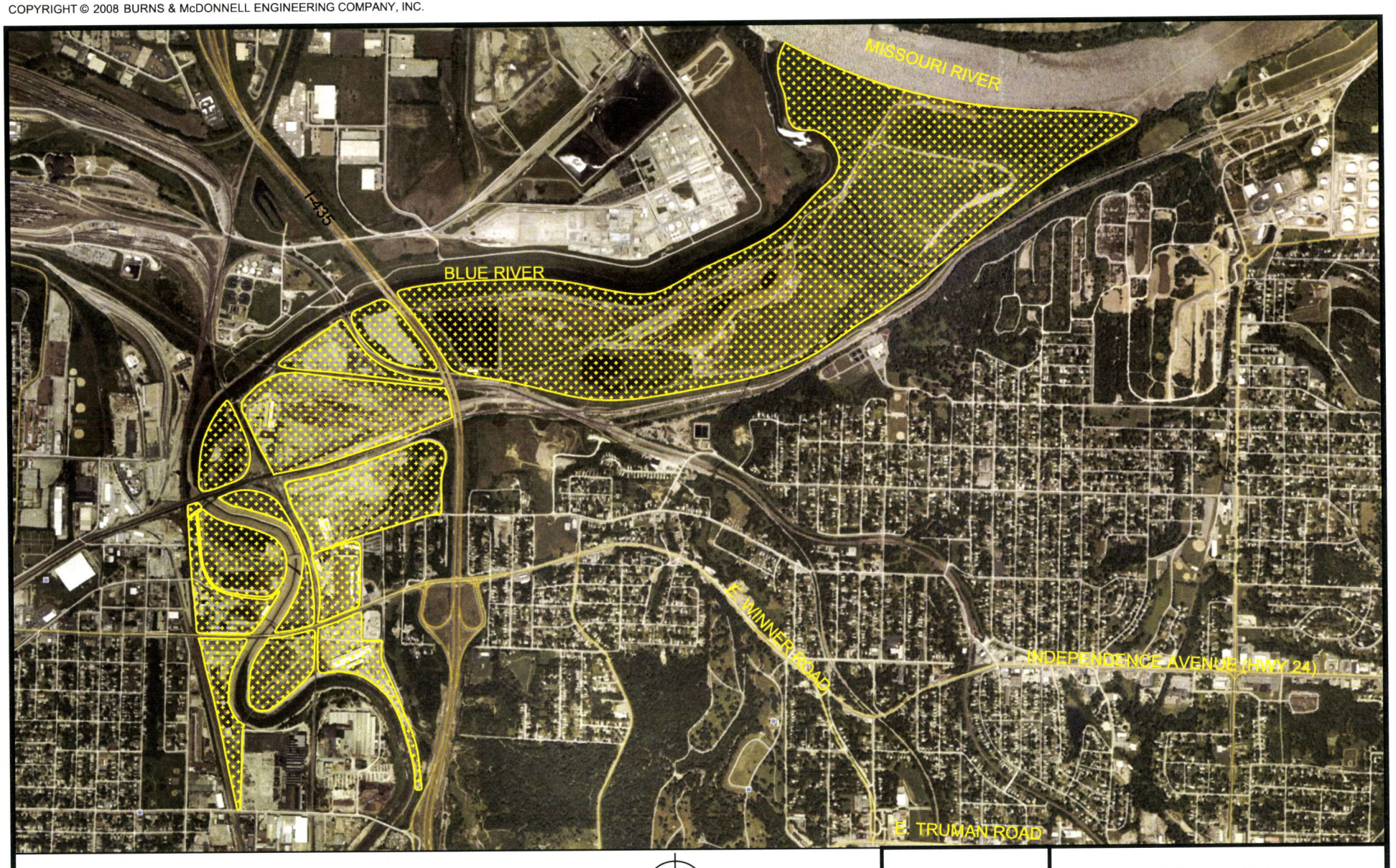
MCL - Safe Drinking Water Act Maximum Contaminant Level (USEPA, 2015)
MCS - Media Cleanup Standard
RSL - Regional Screening Level Summary Table for tapwater (USEPA, 2015)

Table 2-4
Points of Compliance
IM Work Plan
AK Steel Kansas City Facility

Medium	Point of Compliance	SWMUs and AOCs
Soil	The media cleanup standard for soil should be achieved at any point where direct contact exposures to the soils may occur.	SWMU 4 - 1987 Waste Pile SWMU 7 - No. 1 Melt Shop Baghouse Dust Tanks SWMU 33 - Nail Mill Degreasing Area AOC 8 - "Owl Gun Club" Shooting Park
Soil	The media cleanup standard for soil should be achieved at any point where direct contact exposures to the soils may occur and at any other points necessary to protect against unacceptable migration to groundwater.	SWMU 33 - Nail Mill Degreasing Area
Groundwater	The media cleanup standard for groundwater should generally be achieved throughout the contaminated groundwater. When waste is left in place, the media cleanup standard for groundwater should generally be achieved up to the outside boundary of the area(s) encompassing hazardous constituents that are being managed in place as part of a remedial action. USEPA refers to this as the "throughout-the-plume/unit boundary" point of compliance for groundwater.	SWMU 33 - Nail Mill Degreasing Area

AOC - Area of Concern
SWMU - Solid Waste Management Unit
USEPA - United States Environmental Protection Agency

FIGURES



LEGEND:

RCRA FACILITY BOUNDARY

NORTH

0 2000' 4000'

SCALE IN FEET

BURNS McDONNELL

Figure 1-1

FACILITY LOCATION MAP
AK STEEL
KANSAS CITY, MISSOURI

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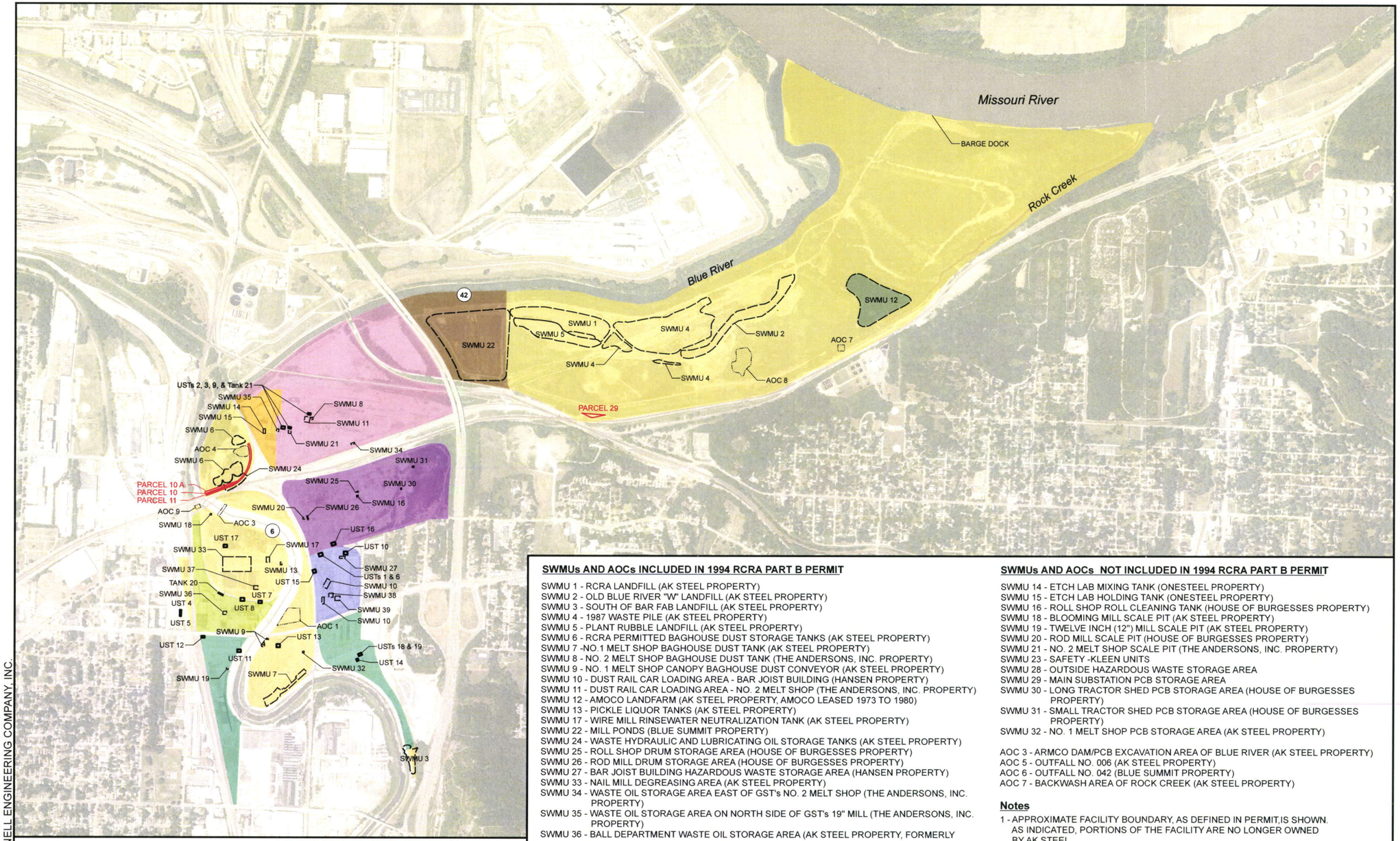

Legend

- (6) OUTFALL
- AOC BOUNDARY
- SWMU BOUNDARY
- LOCATION OF FORMER USTs BELONGING TO AOC 2; TANK
- CITY OWNED PARCEL
- AK STEEL PROPERTY
- THE ANDERSONS, INC. PROPERTY (FORMERLY GST)
- AK STEEL PROPERTY FORMERLY LEASED TO GST
- AK STEEL PROPERTY FORMERLY LEASED TO AMOCO
- HANSEN PROPERTY DEVELOPMENT, INC. (FORMERLY GST) D.B.A. U-PICK-IT OF KANSAS CITY
- HOUSE OF BURGESSES LLC PROPERTY (FORMERLY GST) D.B.A. MIDWEST SCRAP MANAGEMENT
- CTE PROPERTIES LLC OR CTE PROPERTIES II LLC (FORMERLY GST) D.B.A. CUSTOM TRUCK & EQUIPMENT
- ONE STEEL GRINDING SYSTEMS LLC (FORMERLY GST)
- BLUE SUMMIT LLC (FORMERLY GST)

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SWMUs AND AOCs INCLUDED IN 1994 RCRA PART B PERMIT

SWMU 1 - RCRA LANDFILL (AK STEEL PROPERTY)
SWMU 2 - OLD BLUE RIVER "W" LANDFILL (AK STEEL PROPERTY)
SWMU 3 - SOUTH OF BAR FAB LANDFILL (AK STEEL PROPERTY)
SWMU 4 - 1987 WASTE PILE (AK STEEL PROPERTY)
SWMU 5 - PLANT RUBBLE LANDFILL (AK STEEL PROPERTY)
SWMU 6 - RCRA PERMITTED BAGHOUSE DUST STORAGE TANKS (AK STEEL PROPERTY)
SWMU 7 -NO.1 MELT SHOP BAGHOUSE DUST TANK (AK STEEL PROPERTY)
SWMU 8 - NO. 2 MELT SHOP BAGHOUSE DUST TANK (THE ANDERSONS, INC. PROPERTY)
SWMU 9 - NO. 1 MELT SHOP CANOPY BAGHOUSE DUST CONVEYOR (AK STEEL PROPERTY)
SWMU 10 - DUST RAIL CAR LOADING AREA - BAR JOIST BUILDING (HANSEN PROPERTY)
SWMU 11 - DUST RAIL CAR LOADING AREA - NO. 2 MELT SHOP (THE ANDERSONS, INC. PROPERTY)
SWMU 12 - AMOCO LANDFARM (AK STEEL PROPERTY, AMOCO LEASED 1973 TO 1980)
SWMU 13 - PICKLE LIQUOR TANKS (AK STEEL PROPERTY)
SWMU 17 - WIRE MILL RINSEWATER NEUTRALIZATION TANK (AK STEEL PROPERTY)
SWMU 22 - MILL PONDS (BLUE SUMMIT PROPERTY)
SWMU 24 - WASTE HYDRAULIC AND LUBRICATING OIL STORAGE TANKS (AK STEEL PROPERTY)
SWMU 25 - ROLL SHOP DRUM STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 26 - ROD MILL DRUM STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 27 - BAR JOIST BUILDING HAZARDOUS WASTE STORAGE AREA (HANSEN PROPERTY)
SWMU 33 - NAIL MILL DEGREASING AREA (AK STEEL PROPERTY)
SWMU 34 - WASTE OIL STORAGE AREA EAST OF GST's NO. 2 MELT SHOP (THE ANDERSONS, INC. PROPERTY)
SWMU 35 - WASTE OIL STORAGE AREA ON NORTH SIDE OF GST's 19" MILL (THE ANDERSONS, INC. PROPERTY)
SWMU 36 - BALL DEPARTMENT WASTE OIL STORAGE AREA (AK STEEL PROPERTY, FORMERLY GST LEASED)
SWMU 37 - WIRE MILL WASTE OIL STORAGE AREA (AK STEEL PROPERTY)
SWMU 38 - BAR JOIST TEMPORARY GREASE STORAGE AREA (HANSEN PROPERTY)
SWMU 39 - BAR JOIST WASTE OIL AND GREASE STORAGE AREA (HANSEN PROPERTY)

AOC 1 - ABANDONED FUEL OIL STORAGE TANK (AK STEEL PROPERTY)
AOC 2 - UNDERGROUND STORAGE TANKS (USTs AK STEEL, MILE RAIL, HANSEN, CTE PROPERTIES, AND HOUSE OF BURGESSES LLC PROPERTIES)
AOC 4 - BOILER FURNACE AREA (AK STEEL PROPERTY)
AOC 8 - "OWL GUN CLUB" SHOOTING PARK (AK STEEL PROPERTY)
AOC 9 - BOILER HOUSE (AK STEEL PROPERTY)

SWMUs AND AOCs NOT INCLUDED IN 1994 RCRA PART B PERMIT

SWMU 14 - ETCH LAB MIXING TANK (ONESTEEL PROPERTY)
SWMU 15 - ETCH LAB HOLDING TANK (ONESTEEL PROPERTY)
SWMU 16 - ROLL SHOP ROLL CLEANING TANK (HOUSE OF BURGESSES PROPERTY)
SWMU 18 - BLOOMING MILL SCALE PIT (AK STEEL PROPERTY)
SWMU 19 - TWELVE INCH (12") MILL SCALE PIT (AK STEEL PROPERTY)
SWMU 20 - ROD MILL SCALE PIT (HOUSE OF BURGESSES PROPERTY)
SWMU 21 - NO. 2 MELT SHOP SCALE PIT (THE ANDERSONS, INC. PROPERTY)
SWMU 23 - SAFETY -KLEEN UNITS
SWMU 28 - OUTSIDE HAZARDOUS WASTE STORAGE AREA
SWMU 29 - MAIN SUBSTATION PCB STORAGE AREA
SWMU 30 - LONG TRACTOR SHED PCB STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 31 - SMALL TRACTOR SHED PCB STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 32 - NO. 1 MELT SHOP PCB STORAGE AREA (AK STEEL PROPERTY)

AOC 3 - ARMCO DAM/PCB EXCAVATION AREA OF BLUE RIVER (AK STEEL PROPERTY)
AOC 5 - OUTFALL NO. 006 (AK STEEL PROPERTY)
AOC 6 - OUTFALL NO. 042 (BLUE SUMMIT PROPERTY)
AOC 7 - BACKWASH AREA OF ROCK CREEK (AK STEEL PROPERTY)

Notes

1 - APPROXIMATE FACILITY BOUNDARY, AS DEFINED IN PERMIT,IS SHOWN. AS INDICATED, PORTIONS OF THE FACILITY ARE NO LONGER OWNED BY AK STEEL.
2 - AREAS HISTORICALLY DECOMMISSIONED AND DEMOLISHED: NO. 1 MELT SHOP, ROD MILL, ROLL SHOP, AND NO. 2 MELT SHOP.
3 - LOCATIONS OF SWMUS AND AOCS NOT INCLUDED IN THE 1994 RCRA PART B PERMIT ARE APPROXIMATE AND NOT BASED ON SURVEY INFORMATION. THE LOCATIONS OF THESE SWMUS AND AOCS ARE BASED UPON FIG. 6 OF THE RCRA FACILITY ASSESSMENT (TETRA TECH, 1992).
4 - ONLY OUTFALLS IDENTIFIED IN THE RCRA FACILITY ASSESSMENT ARE INCLUDED ON THIS FIGURE.
5 - THE LOCATIONS OF SWMUS 23, 28, AND 29 ARE UNKNOWN.

1,000 500 0 1,000
Feet

Data Source = ESRI and Burns & McDonnell Engineering Company, Inc.

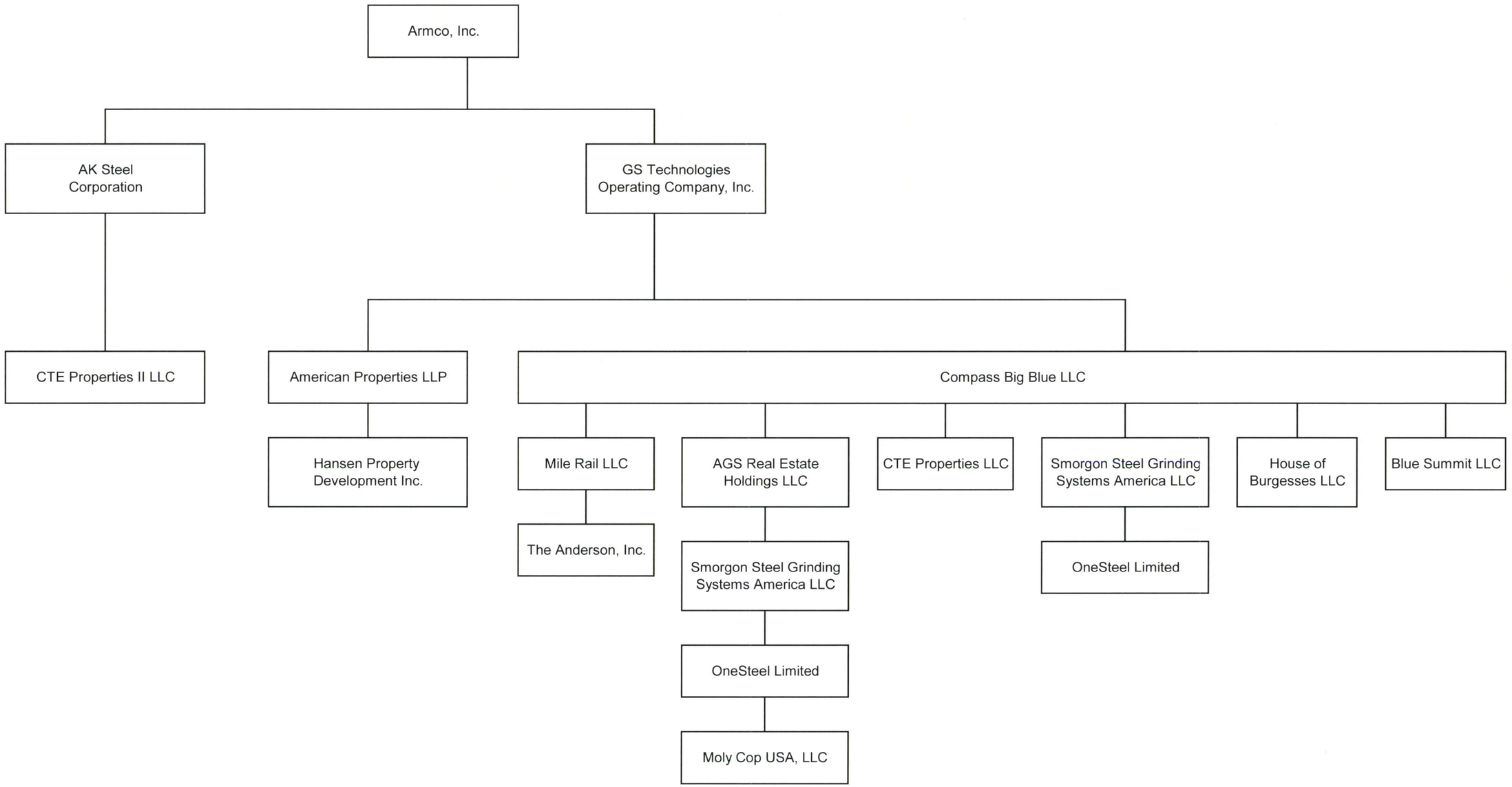
NORTH

BURNS McDONNELL

Figure 1-2

FACILITY OWNERSHIP MAP

AK STEEL FACILITY
KANSAS CITY, MISSOURI



Note: Ownership based on search of Jackson County, Missouri online public records (http://records.co.jackson.mo.us/localization/menu.asp).
All tracts CBB required through the GST bankruptcy have been sold.
American Grinding Systems (AGS) was sold to Smorgon Steel in October 2004, and Smorgon Steel merged with OneSteel Limited in August 2007.
AK Steel sold 15.8 acres to CTE Properties II LLC in February 2013

BURNS McDONNELL

Figure 1-3

Ownership Status

AK Steel Kansas City Facility

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07G01A
07G01E
07G01D
07G02B
07G02A
07G02E
07G02D
07G02C
07G03B
07G03A
07G03E
07G03D
07G03C
07B04A
07B09
07B10
07B13
07B15
07B16
07B17
07B22
07B25
07B34
07B33
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07B19
07B04
07B05
07B23
07B12
07B01
07B01A
07G01B
07G01C
07B08
07B02
07B02A
07B07
07B11
07B03
07B06
07B03A

TRENCH 07TP01
TRENCH 07TP02
TRENCH 07TP03
TRENCH 07TP04
TRENCH 07TP05
TRENCH 07TP06
TRENCH 07TP07
TRENCH 07TP08
TRENCH 07TP09
TRENCH 07TP10
TRENCH 07TP11
TRENCH 07TP12
TRENCH 07TP13
TRENCH 07TP14
TRENCH 07TP15
TRENCH 07TP16
TRENCH 07TP17
TRENCH 07TP18

SWMU 7

Blue River

Legend

Deepest Exceedence of MCS in Borings

- Lead is Below MCS
- 1 Foot Below Ground Surface
- 2 Feet Below Ground Surface
- 3 Feet Below Ground Surface
- 4 Feet Below Ground Surface
- 5 Feet Below Ground Surface

Deepest Exceedence of MCS in Trenches

- Lead is Below Screening
- 4 Feet Below Ground Surface
- 7 Feet Below Ground Surface

- AOC
- SWMU

MCS Media Cleanup Standard

100 50 0 100
Feet

Data Source = ESRI and Burns & McDonnell Engineering Company, Inc.

NORTH

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Figure 3-1
SWMU 7 LOCATION AND EXTENT OF LEAD IN SOIL

AK STEEL FACILITY
KANSAS CITY, MISSOURI

Path: Z:\Clients\ENV\AKSteel\84734_IMWorkPlan\Studies\Geospatial\ArcDocs\Figure3-1_SWMU 7 Pb in Soil.mxd

Contaminant Sources	Affected Media	Transport Mechanisms	Contact Media	Exposure Routes	Potential Receptors: On-Site – Future Indoor Worker	On-Site – Current/Future Outdoor Worker	On-Site – Future Construction Worker
SWMU 7 No. 1 Melt Shop Baghouse Dust Tank	Surface Soil	Dust Emissions	Air	Inhalation of Fugitive Dust	O	●	O
			Surface Soil	Ingestion		●	O
				Dermal Contact		●	O
		Stormwater Runoff	Surface Soil	Ingestion			
				Dermal Contact			
			Air	Inhalation of Fugitive Dust			
	Subsurface Soil	Dust Emissions	Air	Inhalation of Fugitive Dust			O
			Subsurface Soil	Ingestion			O
				Dermal Contact			O
		Infiltration and Percolation	Water Body Sediment	Ingestion			
				Dermal Contact			
			Water Body Surface Water	Ingestion			
				Dermal Contact			
		Groundwater – Migration	Groundwater	Ingestion			
				Dermal Contact			

LEGEND

- ● Completed Pathway
- O Potentially Completed Pathway
- ☐ Not a completed pathway

7/29/99 k:\human

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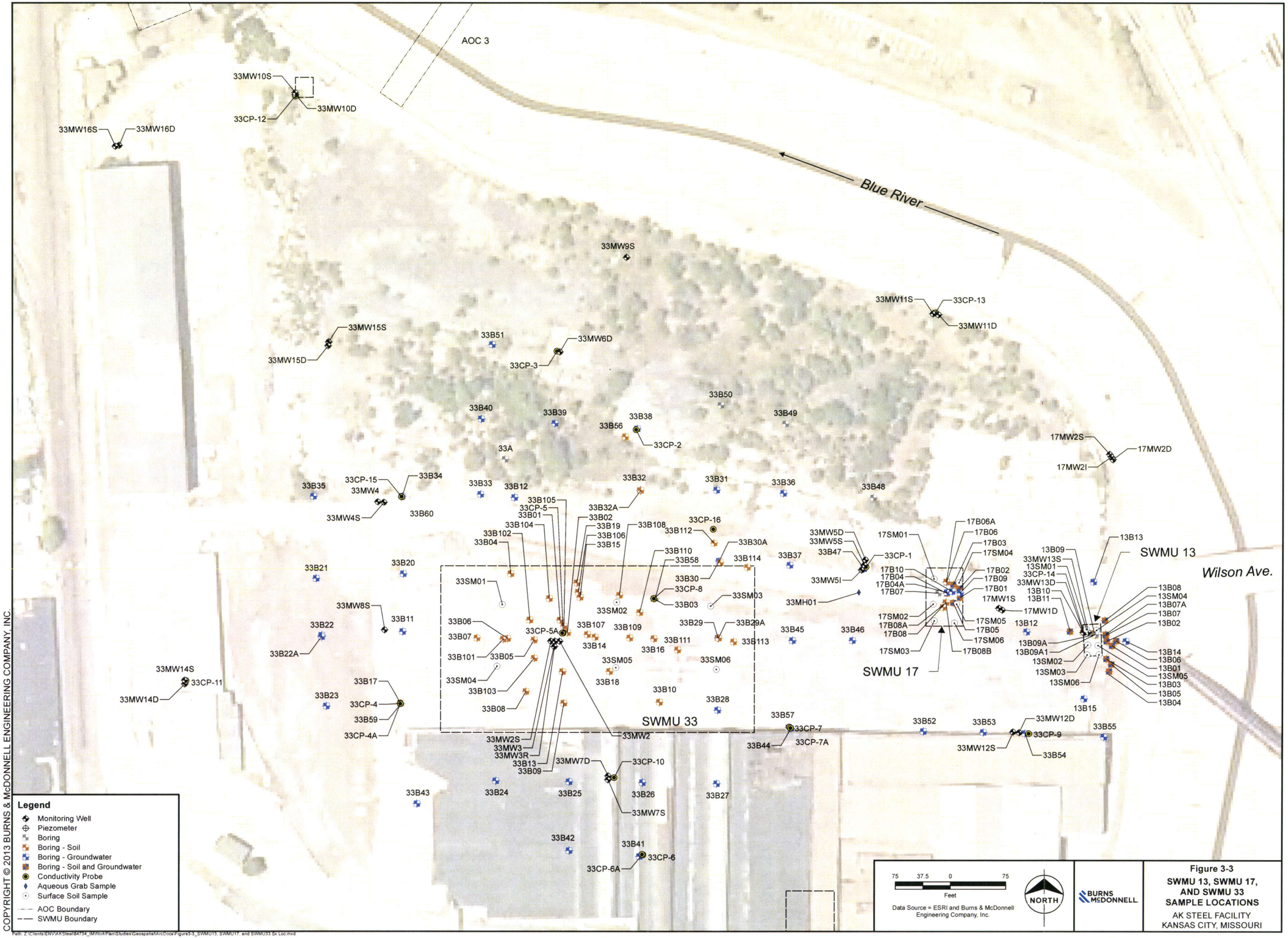
Figure 3-2
Human Health
Conceptual Site Model – SWMU 7
AK Steel Facility
Kansas City, Missouri



Path: Z:\Clients\ENVAKSteel\84734_IM\Work Plan\Studies\Geospatial\ArcDocs\Figure3-3_SWMU13, SWMU17, and SWMU33 Sx Loc.mxd

Figure 3-3
SWMU 13, SWMU 17, AND SWMU 33 SAMPLE LOCATIONS
AK STEEL FACILITY
KANSAS CITY, MISSOURI

33B112
33B30
33B30A
33B114
33B37
33B04
33B20
33B19
33B106
33B108
33B104
33B15
33B03
33B58
33B110
33B102
33B01
33B105
33MW8S
33B11
33B07
33B06
33B05
33B02
33B107
33B14
33B109
33B16
33B29A
33B45
33B101
33MW2
33MW3
33MW2S
33B29
33B113
33B111
33B103
33B13
33B18
33B17
33B59
33B08
33B09
33B10
33B28
33B57
33B44
WIRE MILL BUILDING
33B24
33B25
33MW7S
33MW7D
33B26
33B27
33B43

LEGEND

SWMU 33 BOUNDARY	
33B28 ○	HISTORICAL DIRECT-PUSH BORING LOCATION
33B106 ●	2010 DIRECT-PUSH BORING LOCATION
33MW7D ✳	MONITORING WELL LOCATION

33B14	> 5 mg/kg
33MW2	1 - 5 mg/kg
33B113	0.1 - 1 mg/kg
33B13	NOT DETECTED - 0.1 mg/kg
33B09	NOT DETECTED

NOTES:

1) UNITS ARE MILLIGRAMS PER KILOGRAM (mg/kg)
2) SOIL SAMPLES WERE COLLECTED FROM MULTIPLE DEPTH INTERVALS AT EACH LOCATION. THE COLOR A LOCATION WAS ASSIGNED IS BASED ON THE RESULTS OF THE HIGHEST CONCENTRATION SOIL SAMPLE.

N

0 20' 40' 80'

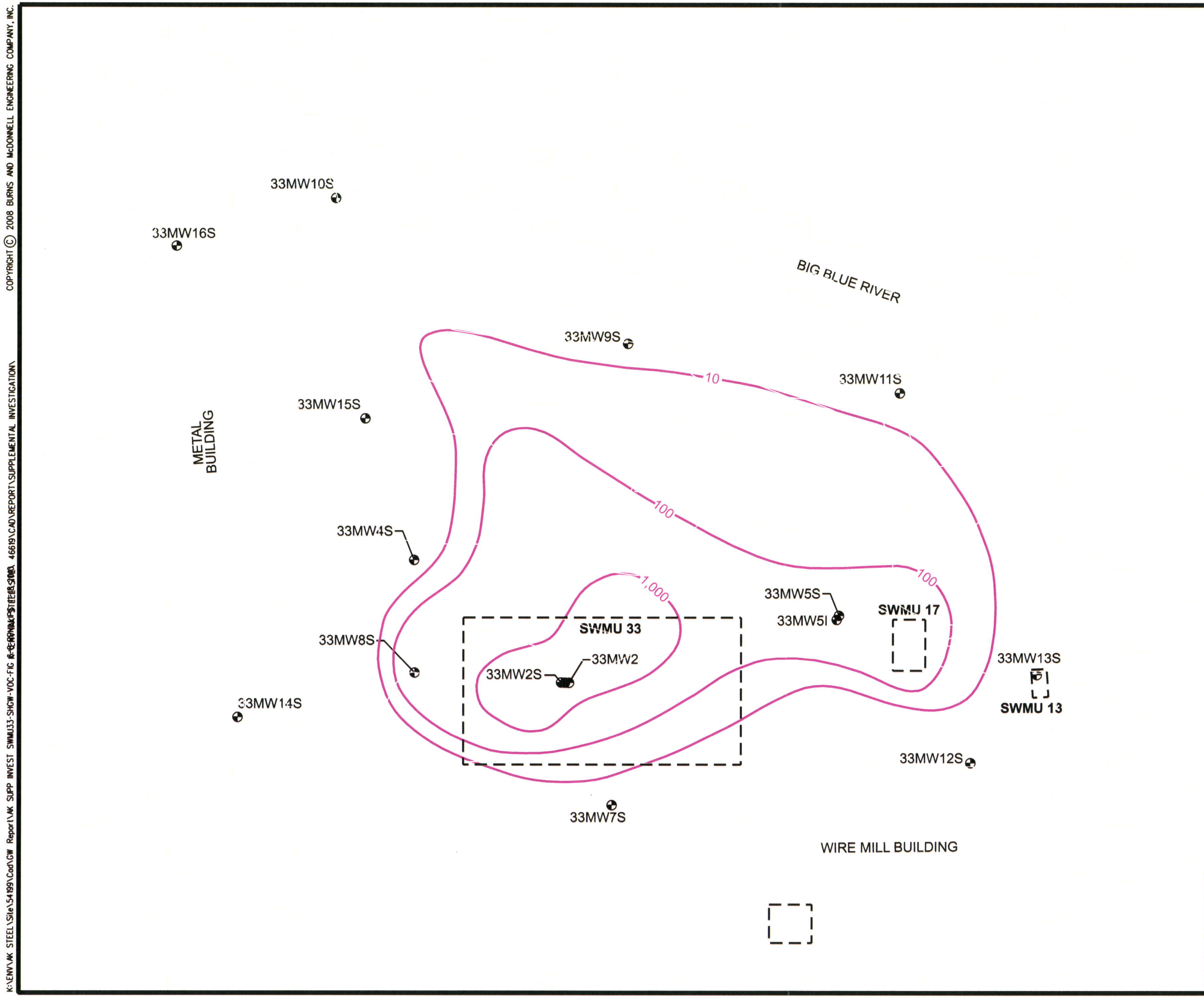
SCALE IN FEET

BURNS McDONNELL

Figure 3-4

TCE IN SOIL
CURRENT AND
HISTORICAL DATA
AK STEEL
KANSAS CITY, MO

K:\ENV\AK STEEL\Site\54200\Cad\54200_FG3-4.dgn 09/14/2010 2:15 RPHILLIPS



LEGEND

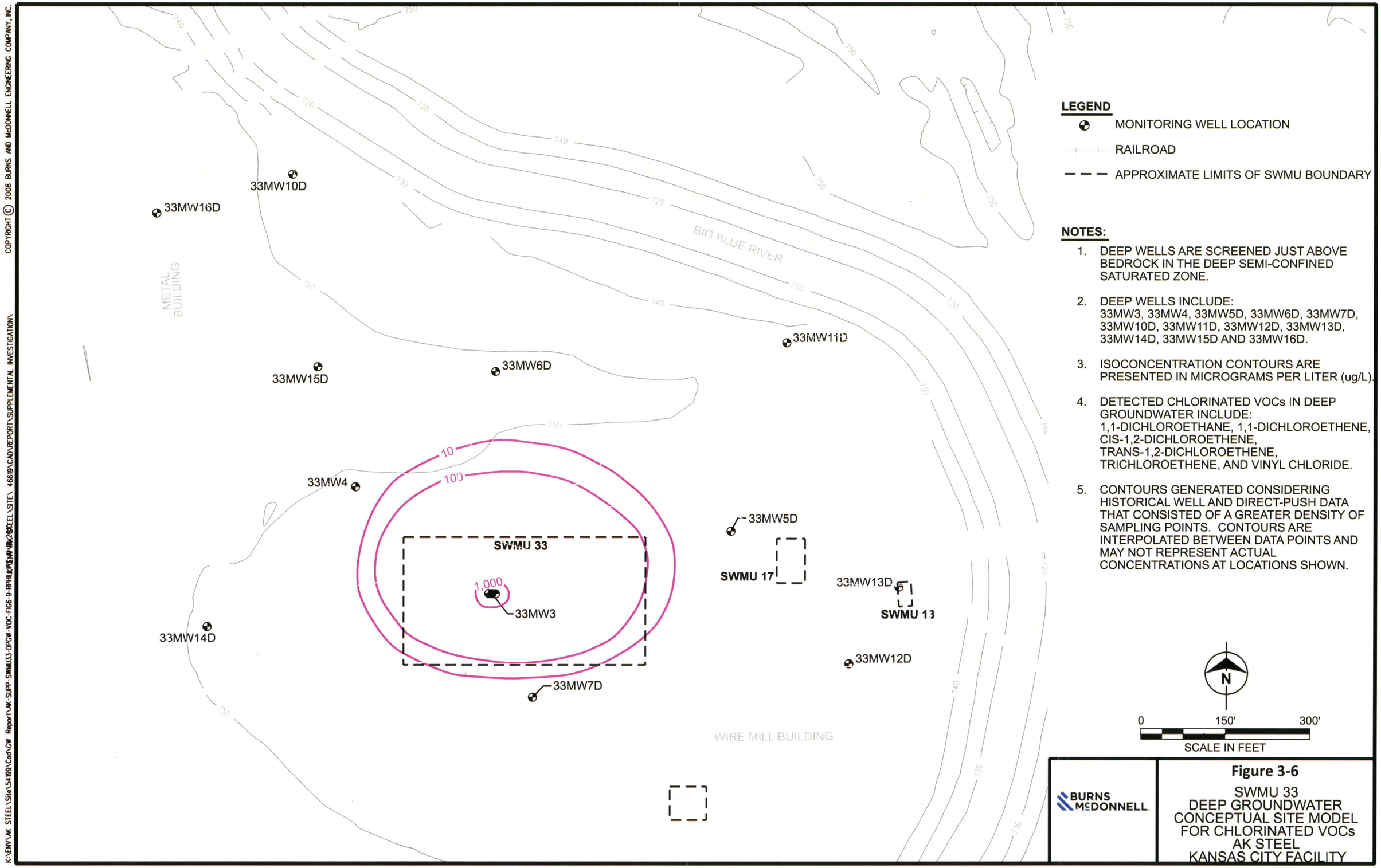
- MONITORING WELL LOCATION
- RAILROAD
- APPROXIMATE LIMITS OF SWMU BOUNDARY

NOTES:

1. SHALLOW WELLS ARE SCREENED IN THE SHALLOW UNCONFINED SATURATED ZONE.
2. SHALLOW WELLS INCLUDE: 33MW2S, 33MW4S, 33MW5S, 33MW7S, 33MW8S, 33MW9S, 33MW10S, 33MW11S, 33MW12S, 33MW13S, 33MW14S, 33MW15S, AND 33MW16S.
3. MONITORING WELLS 33MW2 AND 33MW5I ARE INTERMEDIATE DEPTH WELLS SCREENED DIRECTLY ABOVE THE SEMI-CONFINING LAYER IN THE SHALLOW SATURATED ZONE. THESE WELLS ARE NOT USED IN CONTOURING SHALLOW GROUNDWATER DATA.
4. ISOCONCENTRATION CONTOURS ARE REPORTED IN MICROGRAMS PER LITER (ug/L)
5. CONTOURS GENERATED CONSIDERING HISTORICAL WELL AND DIRECT-PUSH DATA THAT CONSISTED OF A GREATER DENSITY OF SAMPLING POINTS. CONTOURS ARE INTERPOLATED BETWEEN DATA POINTS AND MAY NOT REPRESENT ACTUAL CONCENTRATIONS AT LOCATIONS SHOWN.
6. DETECTED CHLORINATED VOCs IN SHALLOW GROUNDWATER INCLUDE: 1,1-DICHLOROETHENE, 1,1-DICHLOROETHANE CIS-1,2-DICHLOROETHENE, TRANS-1,2-DICHLOROETHENE, TRICHLOROETHENE, AND VINYL CHLORIDE.

BURNS McDONNELL

Figure 3-5
SWMU 33
SHALLOW GROUNDWATER CONCEPTUAL SITE MODEL FOR CHLORINATED VOCs
AK STEEL
KANSAS CITY FACILITY



LEGEND

- MONITORING WELL LOCATION
- RAILROAD
- APPROXIMATE LIMITS OF SWMU BOUNDARY

NOTES:

1. DEEP WELLS ARE SCREENED JUST ABOVE BEDROCK IN THE DEEP SEMI-CONFINED SATURATED ZONE.
2. DEEP WELLS INCLUDE: 33MW3, 33MW4, 33MW5D, 33MW6D, 33MW7D, 33MW10D, 33MW11D, 33MW12D, 33MW13D, 33MW14D, 33MW15D AND 33MW16D.
3. ISOCONCENTRATION CONTOURS ARE PRESENTED IN MICROGRAMS PER LITER (ug/L).
4. DETECTED CHLORINATED VOCs IN DEEP GROUNDWATER INCLUDE: 1,1-DICHLOROETHANE, 1,1-DICHLOROETHENE, CIS-1,2-DICHLOROETHENE, TRANS-1,2-DICHLOROETHENE, TRICHLOROETHENE, AND VINYL CHLORIDE.
5. CONTOURS GENERATED CONSIDERING HISTORICAL WELL AND DIRECT-PUSH DATA THAT CONSISTED OF A GREATER DENSITY OF SAMPLING POINTS. CONTOURS ARE INTERPOLATED BETWEEN DATA POINTS AND MAY NOT REPRESENT ACTUAL CONCENTRATIONS AT LOCATIONS SHOWN.

N

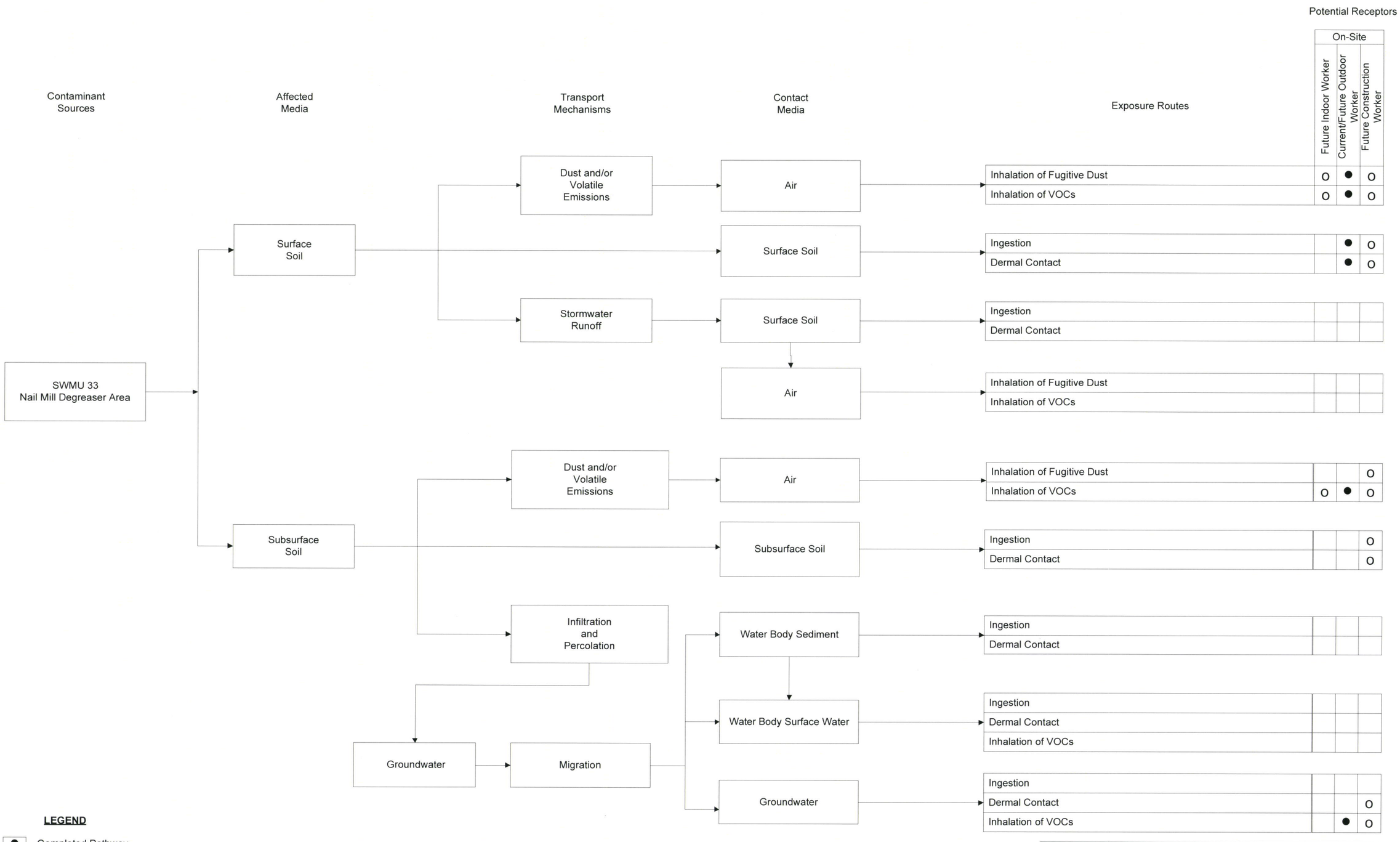
0 150' 300'

SCALE IN FEET

BURNS McDONNELL

Figure 3-6

SWMU 33
DEEP GROUNDWATER
CONCEPTUAL SITE MODEL
FOR CHLORINATED VOCs
AK STEEL
KANSAS CITY FACILITY



7/29/99 k:\human

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Figure 3-7
Human Health
Conceptual Site Model – SWMU 33
AK Steel Facility
Kansas City, Missouri

Blue River

SWMU 1

SWMU 2

SWMU 4

SWMU 5

SWMU 4

SWMU 4

AOC 8

04G03C
04G04A
04G04D
04B04
04G04B
04G04C
04B21
04B22
04G03D
04G03B
04G03A
04B23
04B20
04G02B
04G02C
04B19
04D03
04B05
04B18
04B38
04G02A
04G02D
04B37
04D40
04G01B
04G01C
04G01A
04B01
04B16
04D02
04D26
04D39
04G01D
04B15
04D04
04D27
04D37
04B38
04B08
04B07
04B06
04B34
04B35
04B36
04B13
04B40
04D01
04B42
04B42A
04B11
04B33
04B40A
04B14
04D28
04D29
04D31
04B39
04B30
04B32
04D13
04D05
04B31
04B45
04D30
04B43
04D32
04B41
04D14
04D25
04B48
04B15
04D06
04D12
04D07
04D16
04D24
04D11
04D10
04D08
04D23
04D17
04B44
04D33
04D09
04D34
04D18
04D22
04B46
04D44
04B47
04D19
04B49
04D20
04B50
04D43
04D35
04D42
04D41
04D36

Legend

Deepest Exceedence of MCS for Lead

- Lead is Below Screening
- 1 Foot Below Ground Surface
- 2 Feet Below Ground Surface
- 3 Feet Below Ground Surface
- 4 Feet Below Ground Surface
- 5 Feet Below Ground Surface
- 6 Feet Below Ground Surface
- 8 Feet Below Ground Surface
- 9 Feet Below Ground Surface

AOC

SWMU

Notes

1. Figure presents the deepest sample interval for which lead was observed above the Ecological Screening Level for lead of 140 mg/kg (i.e.- Media Cleanup Standard [MCS]).

175 87.5 0 175

Feet

Data Source = ESRI and Burns & McDonnell Engineering Company, Inc.

NORTH

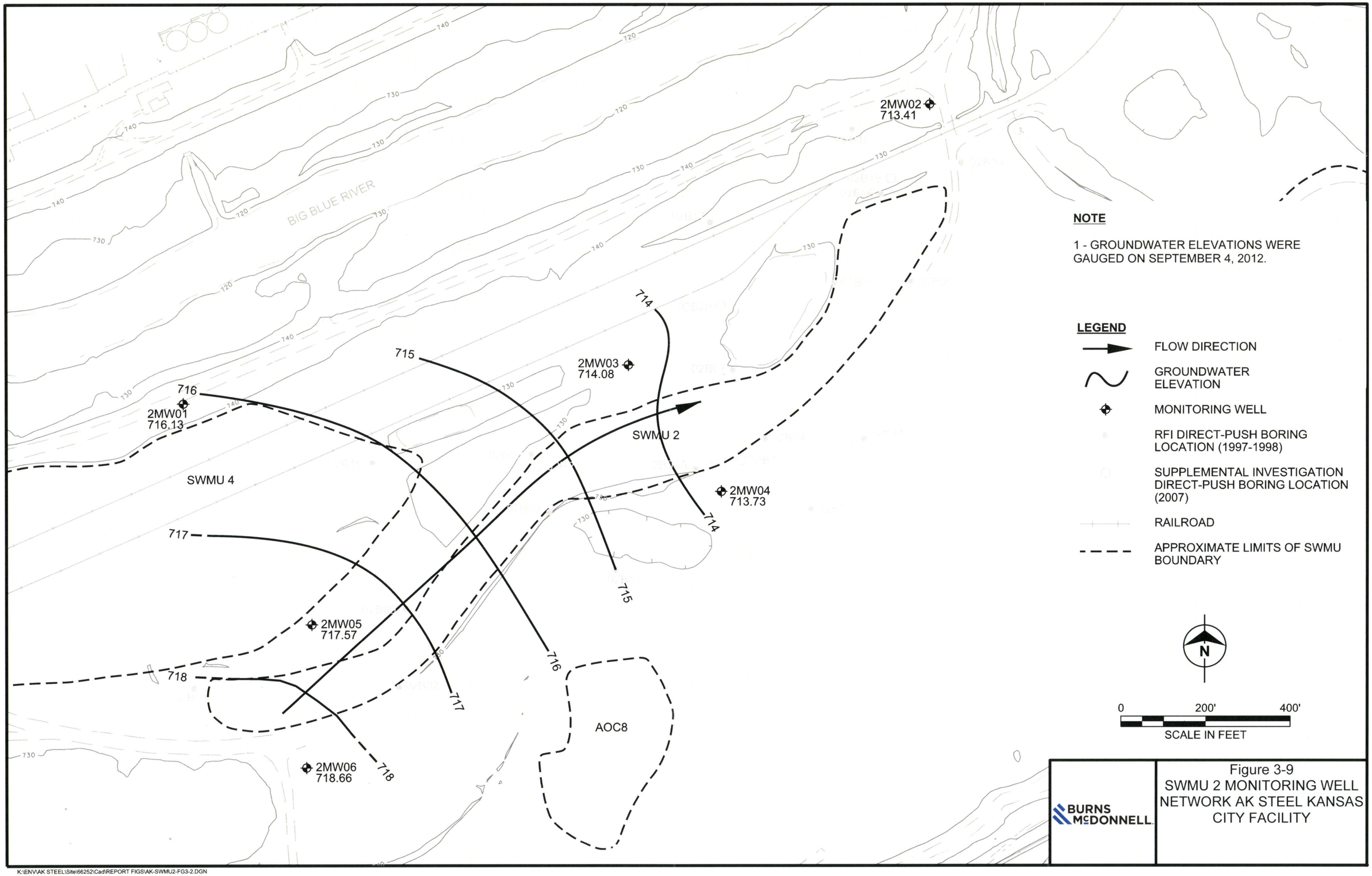
BURNS McDONNELL

Figure 3-8

SWMU 4 - LOCATION AND DISTRIBUTION OF LEAD IN SOIL

AK STEEL FACILITY
KANSAS CITY, MISSOURI

Path: Z:\Clients\ENV\AKSteel\84734_IMWorkPlan\Studies\Geospatial\ArcDocs\Figure3-8_SWMU4 Pb in Soil.mxd



NOTE

1 - GROUNDWATER ELEVATIONS WERE GAUGED ON SEPTEMBER 4, 2012.

LEGEND

- FLOW DIRECTION
- GROUNDWATER ELEVATION
- MONITORING WELL
- RFI DIRECT-PUSH BORING LOCATION (1997-1998)
- SUPPLEMENTAL INVESTIGATION DIRECT-PUSH BORING LOCATION (2007)
- RAILROAD
- APPROXIMATE LIMITS OF SWMU BOUNDARY

N

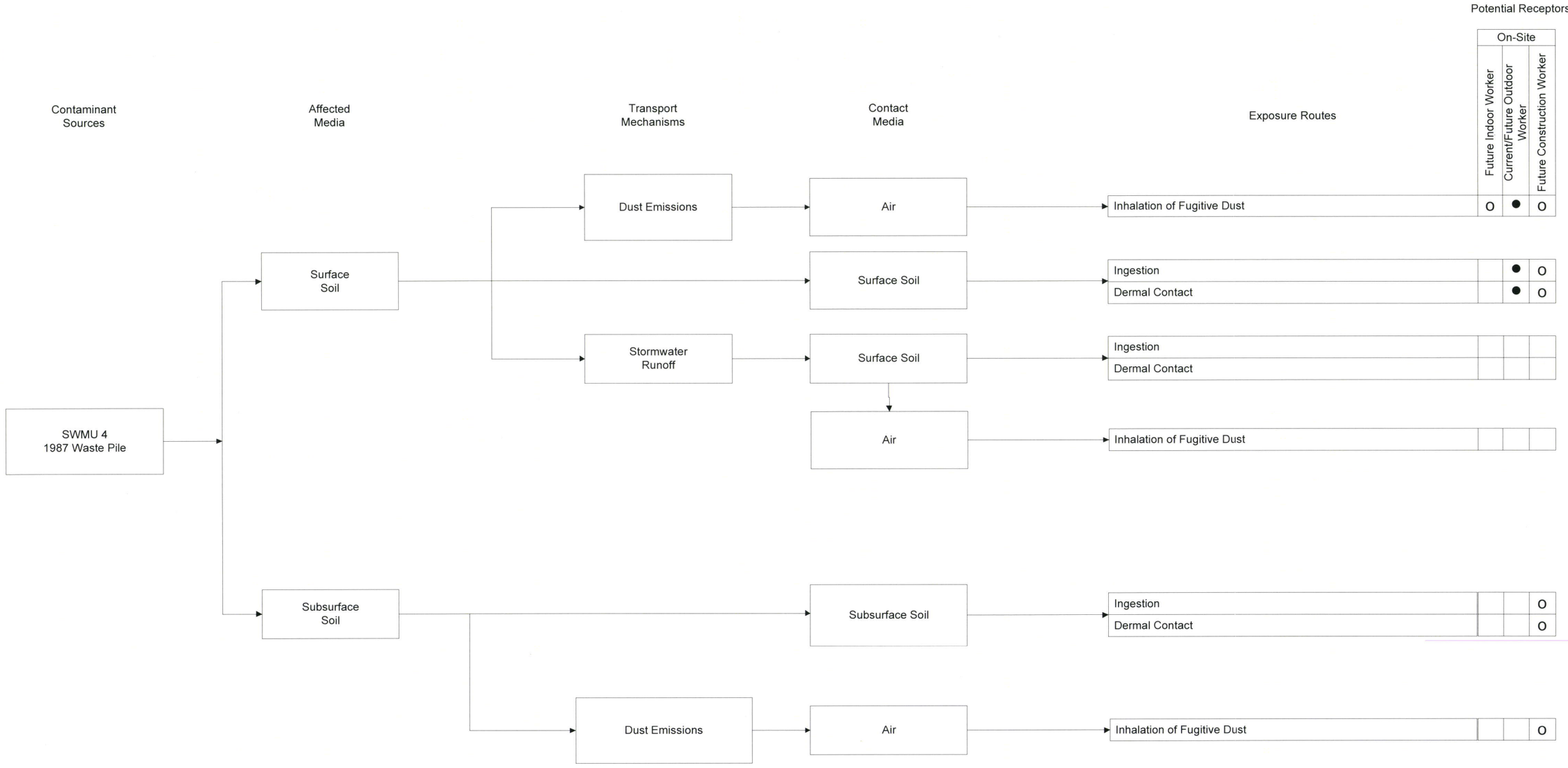
0 200' 400'

SCALE IN FEET

BURNS McDONNELL

Figure 3-9
SWMU 2 MONITORING WELL NETWORK AK STEEL KANSAS CITY FACILITY

K:\ENV\AK STEEL\Site\66252\Cad\REPORT FIGS\AK-SWMU2-FG3-2.DGN



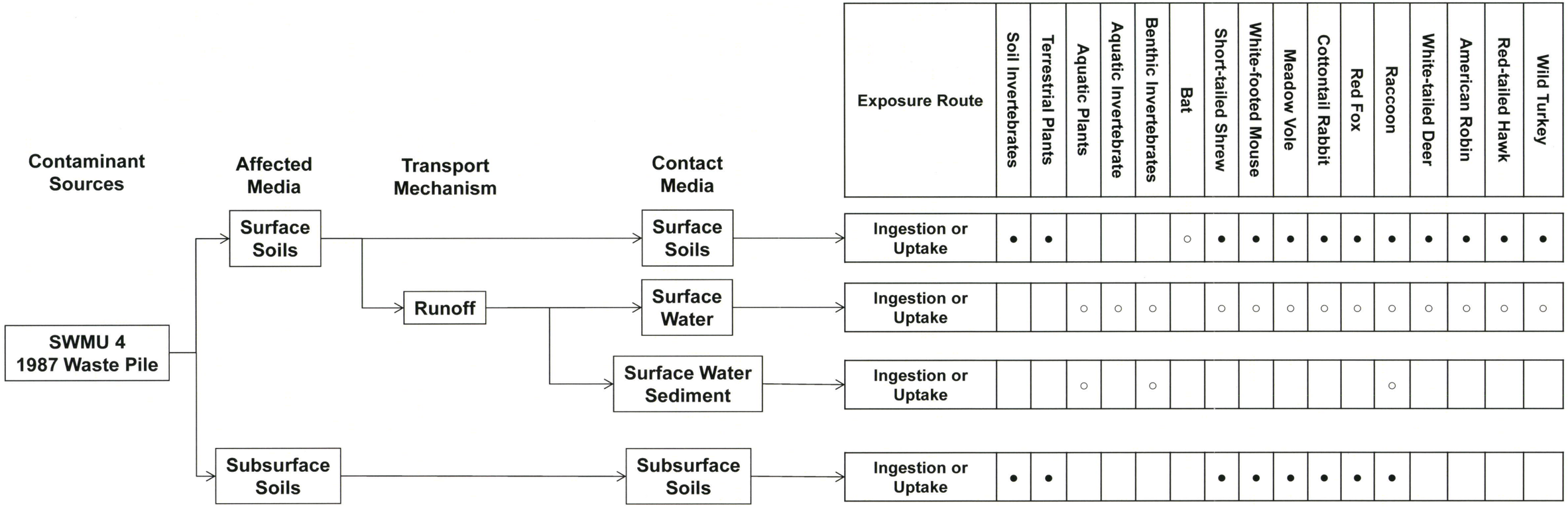
LEGEND

- ● Completed Pathway
- O Potentially Completed Pathway
- ☐ Not a completed pathway

7/29/99 k:\human

BURNS McDONNELL

Figure 3-10
Human Health
Conceptual Site Model – SWMU 4
AK Steel Facility
Kansas City, Missouri



● Completed Pathway

○ Potentially Completed Pathway

▭ Not a Completed Pathway

BURNS McDONNELL

Figure 3-11

ECOLOGICAL CONCEPTUAL SITE MODEL - SWMU 4

AK STEEL FACILITY
KANSAS CITY, MISSOURI

A08B40 A08B38 A08B36 A08B43 A08B44

A08B45

A08B37 A08B32 A08B28

A08B39 A08B35 A08B31 A08B27

A08B29 A08B26

A08B30 A08B33

A08B34 A08B26A

A08B21

A08B20

A08B42 A08B19

A08B25

A08B17 A08B16 A08B15 A08B22

A08B18 A08B41 A08B24

AOC 8

A08B11 A08B10 A08B14

A08B23

A08B12 A08B09

A08B46

A08B05 A08B06

A08G01B A08B13

A08G01A A08G02B

A08B47

A08G02A

A08B01

A08G01E A08B02 A08B07 A08B08

A08G02E

A08B50

A08G02D A08B49

A08G01D A08G01C

A08B48

A08G03A A08G02C A08G03B

A08G04A

A08G04B

A08B04 A08B03

A08G03E

A08G04E A08G04C

A08G03D A08G03C

A08G04D

Legend

Deepest Exceedence of MCS for Lead

- Lead is Below MCS
- 1 Foot Below Ground Surface
- 2 Feet Below Ground Surface
- 3 Feet Below Ground Surface
- 5 Feet Below Ground Surface

AOC Boundary

SWMU Boundary

MCS Media Cleanup Standard

Notes

1. Figure presents the deepest sample interval for which lead was observed above the Ecological Screening Level for lead of 140 mg/kg (i.e.-MCS).

75 37.5 0 75

Feet

Data Source = ESRI and Burns & McDonnell Engineering Company, Inc.

NORTH

BURNS McDONNELL

Figure 3-12

AOC 8 LOCATION AND EXTENT OF LEAD IN SOIL

AK STEEL FACILITY
KANSAS CITY, MISSOURI

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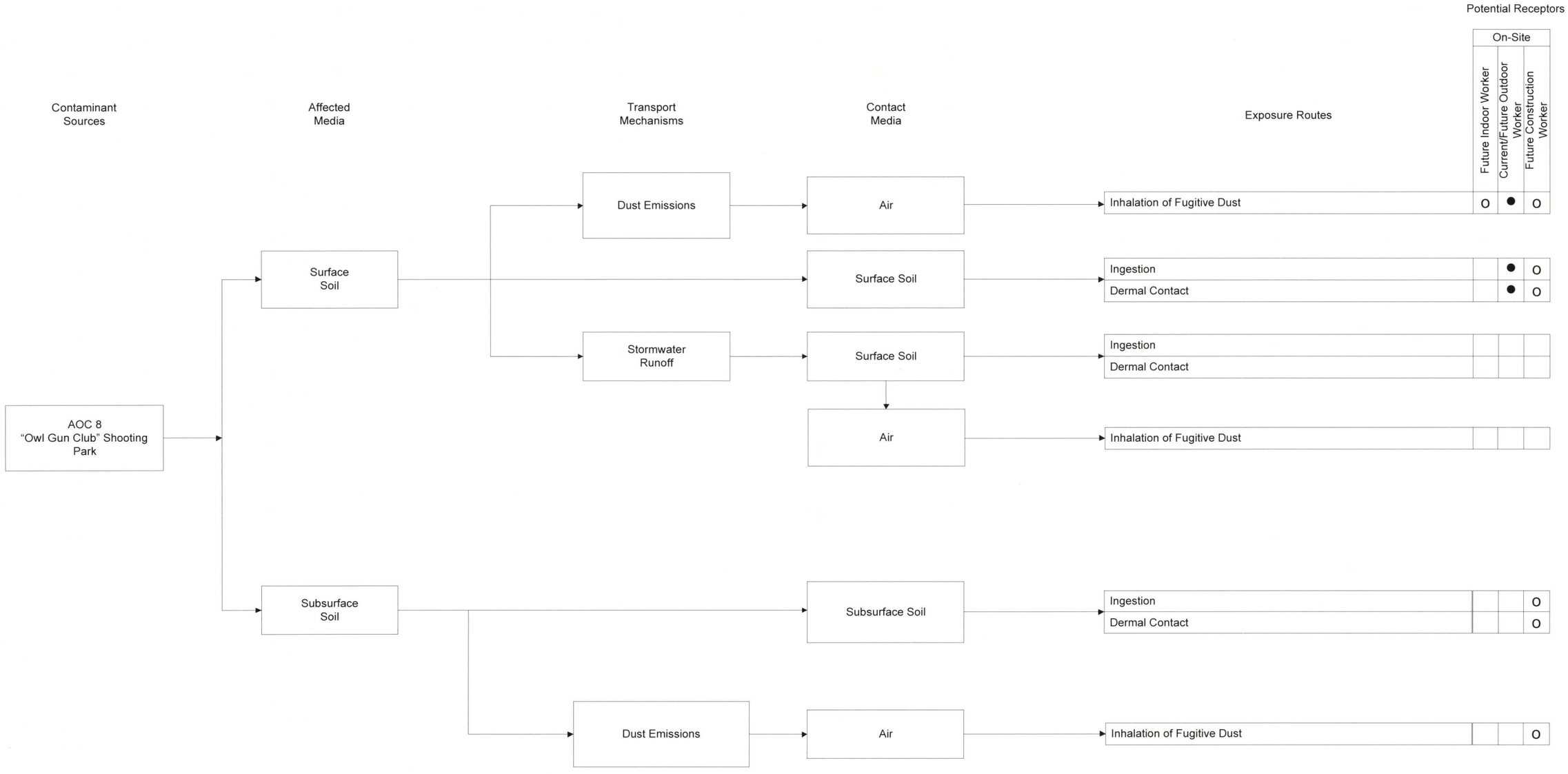

7/29/99 k:\human

BURNS McDONNELL

Figure 3-13
Human Health
Conceptual Site Model – AOC 8
AK Steel Facility
Kansas City, Missouri

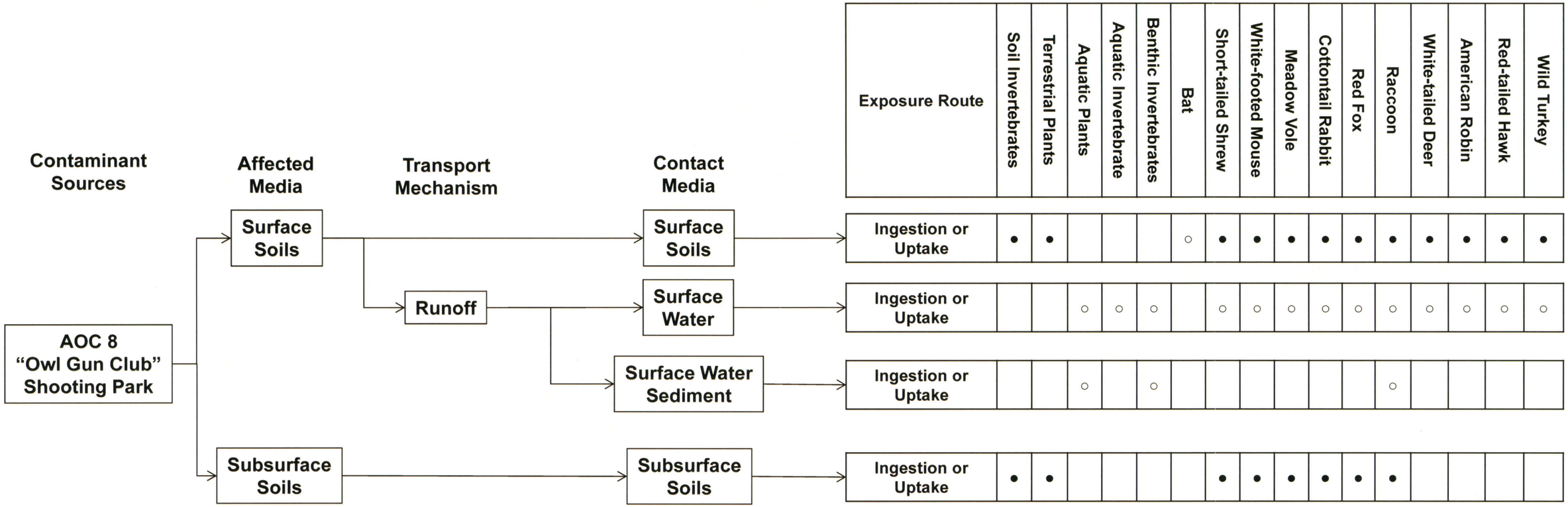

Figure 3-14

ECOLOGICAL CONCEPTUAL SITE MODEL – AOC 8

AK STEEL FACILITY
KANSAS CITY, MISSOURI

Blue River →

SWMU 1

SWMU 5

SWMU 4

SWMU 4

SWMU 4

SWMU 2

AOC 8

Legend

Deepest Exceedence of MCS for Lead

- Lead is Below MCS
- 1 Foot Below Ground Surface
- 2 Feet Below Ground Surface
- 3 Feet Below Ground Surface
- 4 Feet Below Ground Surface
- 5 Feet Below Ground Surface
- 6 Feet Below Ground Surface
- 8 Feet Below Ground Surface
- 9 Feet Below Ground Surface
- Approximate Extent of Proposed Consolidation Cell

- AOC
- SWMU

Depth of Excavation

- 1 Foot Below Ground Surface
- 2 Feet Below Ground Surface
- 3 Feet Below Ground Surface
- 4 Feet Below Ground Surface
- 6 Feet Below Ground Surface

Notes

1. Figure presents the deepest sample interval for which lead was observed at concentrations above the MCS for lead in soil east of I-435 of 140 mg/kg.
2. The consolidation cell presented in this Figure is proposed under Alternative 3 developed for SWMU 4 and AOC 8 in the CMS Report.

175 87.5 0 175

Feet

Data Source = ESRI and Burns & McDonnell Engineering Company, Inc.

NORTH

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Figure 4-1
SWMU 4/AOC 8
CONSOLIDATE AND CAP

AK STEEL FACILITY
KANSAS CITY, MISSOURI

Path: Z:\Clients\ENV\AKSteel\84734_IMWorkPlan\Studies\Geospatial\ArcDocs\Figure4-1_ SWMU 4 AOC8 Interim Measure.mxd

SWMU 19

07G01A
07G01E
07G01D
07G02B
07G02A
07G02E
07G02D
07G02C
07G03B
07G03A
07G03E
07G03D
07G03C
07B04A
07B09
07B10
07B13
07B15
07B16
07B17
07B05
07B23
07B12
07B01
07B01A
07G01B
07G01C
07B08
07B02
07B02A
07B07
07B11
07B03
07B06
07B03A
07B04
07B29
07B30
07B19
07B20
07B14
07B18
07B21
07B22
07B25
07B34
07B33
07B31
07B32
07B36
07B32A
07B37
07B28
07B27
07B24
07B26
07B35
SWMU 7
TRENCH 07TP01
TRENCH 07TP02
TRENCH 07TP03
TRENCH 07TP04
TRENCH 07TP05
TRENCH 07TP06
TRENCH 07TP07
TRENCH 07TP08
TRENCH 07TP09
TRENCH 07TP10
TRENCH 07TP11
TRENCH 07TP12
TRENCH 07TP13
TRENCH 07TP14
TRENCH 07TP15
TRENCH 07TP16
TRENCH 07TP17
TRENCH 07TP18
Blue River

Legend

Deepest Exceedence of MCS for Lead in Borings

- Lead is Below MCS
- 1 Foot Below Ground Surface
- 2 Feet Below Ground Surface
- 3 Feet Below Ground Surface
- 4 Feet Below Ground Surface
- 5 Feet Below Ground Surface

Deepest Exceedence of MCS for Lead in Trenches

- Lead is Below MCS
- 4 Feet Below Ground Surface
- 7 Feet Below Ground Surface

Soil Horizons to Be Removed During IM

- 0 to 1 Foot Below Ground Surface
- 0 to 2 Feet Below Ground Surface
- 0 to 3 Feet Below Ground Surface
- 0 to 5 Feet Below Ground Surface
- 4 to 5 Feet Below Ground Surface
- 0 to 8 Feet Below Ground Surface

AOC Boundary
SWMU Boundary
MCS Media Cleanup Standard

Notes

1. Figure presents the deepest sample interval for which lead was observed at concentrations above the site-specific PRG for lead of 1,531 mg/kg (i.e. - MCS).
2. Exceedences noted for Test Pit 07TP07 were for the depth interval 3-4 feet bgs. Samples collected from 0-3 feet below ground surface were below the MCS for lead.

100 50 0 100
Feet

Data Source = ESRI and Burns & McDonnell Engineering Company, Inc.

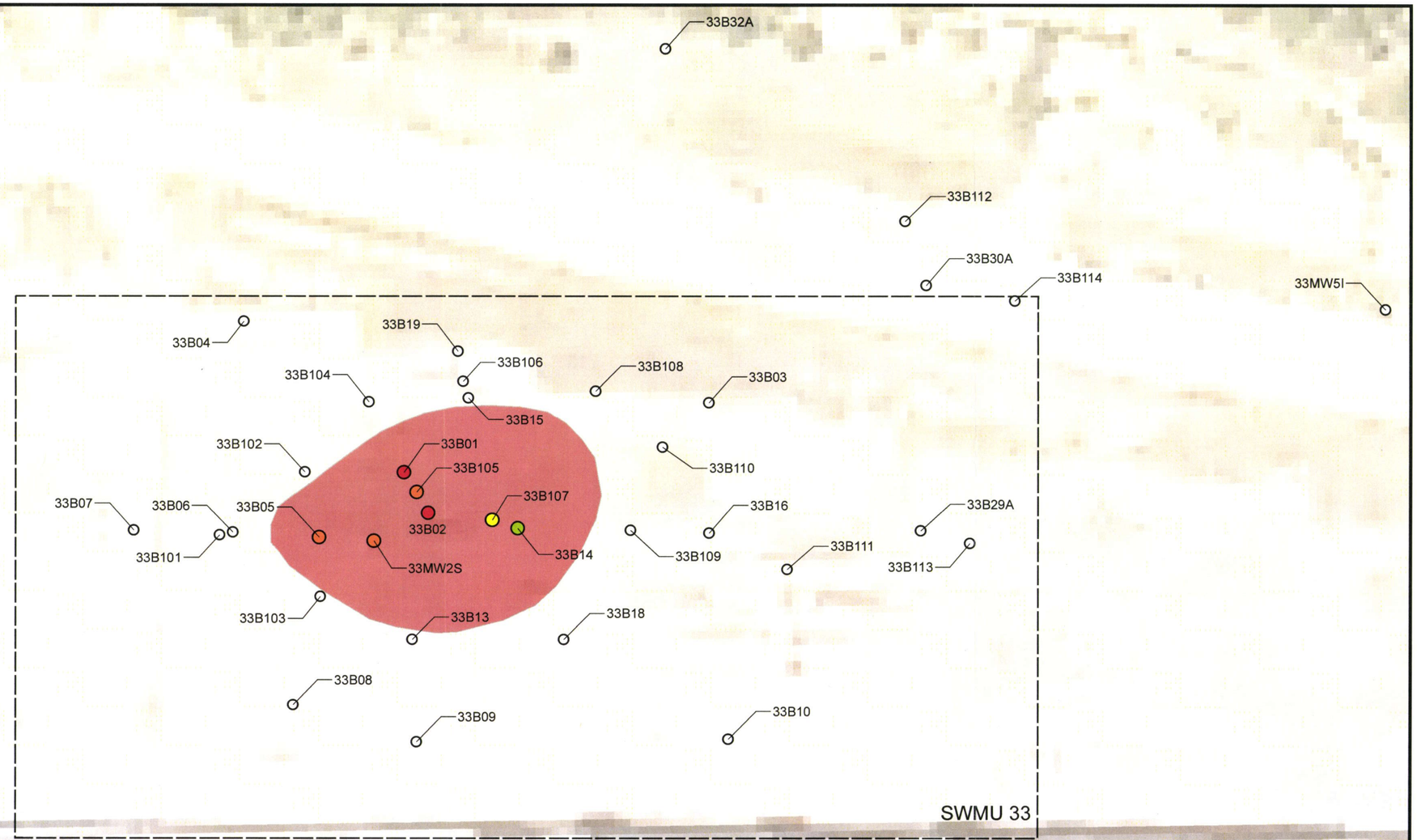
NORTH

BURNS McDONNELL

Figure 4-2
SWMU 7
HOT SPOT REMOVAL

AK STEEL FACILITY
KANSAS CITY, MISSOURI

Path: Z:\Clients\ENV\AKSteel\84734_IMWorkPlan\Studies\Geospatial\ArcDocs\Figure4-2_SWMU 7 Hot Spot Removal.mxd



Legend

Deepest Exceedence of MCS for TCE

- No Exceedences Observed
- 3 Feet Below Ground Surface
- 6 Feet Below Ground Surface
- 8 Feet Below Ground Surface
- 13 Feet Below Ground Surface

Approximate Extent of Excavation to 10 Feet Below Ground Surface

AOC Boundary

SWMU Boundary

MCS - Media Cleanup Standard
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
TCE - Trichloroethylene

Notes

1. Figure presents the deepest sample interval for which TCE was observed at concentrations above the soil MCS of 6.4 mg/Kg or the SPLP analysis was above the MCS for groundwater of 0.005 mg/L.

50 25 0 50
Feet

Data Source = ESRI and Burns & McDonnell Engineering Company, Inc.

NORTH

BURNS McDONNELL

Figure 4-3

SWMU 33
EXCAVATION AND DISPOSAL

AK STEEL FACILITY
KANSAS CITY, MISSOURI

Path: Z:\Clients\ENV\AKSteel\84734_IMWorkPlan\Studies\GeospatialArcDocs\Figure4-3_SWMU 33 Excavation and Disposal.mxd

APPENDIX A - TECHNICAL SPECIFICATIONS

DIVISION 31 - EARTHWORK

SECTION 312000 - SITE PREPARATION AND EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes Site preparation activities and certain items of earthwork common to other related Work.

B. Related Work Specified Elsewhere:

1. Excavation, Filling, and Backfilling: SECTION 312300.

1.02 REFERENCES:

A. Applicable Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. T99 - The Moisture-Density Relations of Soils Using a 5.5-Pound (2.5-kg) Rammer and a 12-Inch (305-mm) Drop.
2. American Society for Testing and Materials (ASTM):
   a. D2167 - Test Method for Density and Unit Weight of Soil In-Place by Rubber Balloon Method.
   b. D4253 - Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   c. D4254 - Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   d. D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   e. D4546 - Test Methods for One-Dimensional Swell/Settlement Potential of Cohesive Soils.
   f. D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.03 SUBMITTALS: NOT APPLICABLE.

PART 2 - PRODUCTS

2.01 EARTHWORK:

A. General Site Embankment and Fill

1. Materials suitable for use in embankment and fill include material free of debris, roots, organic matter, and frozen matter; and free of stone having any dimension greater than 2 inches in areas requiring a high degree of compaction, including soil cover and subgrade, or 6 inches in other embankment and fill areas:

a. Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands exclusive of clayey material:

(1) Free-draining.

(2) Materials for which impact compaction will not produce a well-defined, moisture-density relationship curve.

(3) Maximum density by impact methods will generally be less than by vibratory methods.

(4) For which generally less than 15% by dry weight, of soil particles pass the 75 μm (No. 200) sieve.

b. Cohesive materials include silts and clays generally exclusive of sands and gravel:

(1) Materials for which impact compaction will produce a well-defined, moisture-density relationship curve.

2. Materials unsuitable for use in embankment and fill include all material that contains debris, roots, organic matter, frozen matter, gravel, stone, or shale particles with any dimension greater than 2 inches in areas requiring a high degree of compaction or 6 inches in other embankment and fill areas, or other materials that are determined by Engineer to be too wet or otherwise unsuitable for providing a stable subgrade or stable foundation for structures.

B. Waste Material:

1. For the purposes of this Project, Waste Material shall be defined as any material, soil or sediment that visually contains building debris, ash bricks and other building materials.

C. Consolidation Material:

1. For the purposes of this Project, Consolidation Materials are defined as any soil that is planned for excavation that exceeds the non-residential land use media cleanup standards

for soil as detailed in the Corrective Measures Study Report, AK Steel, Kansas City, Missouri ([CMS] Burns & McDonnell, 2013) and below:

a. SWMUs 7 and 33: USEPA RSLs for industrial soil.

(1) Exceptions will be made for lead, which has a site-specific preliminary remediation goal (PRG), and for arsenic and benzo(a)pyrene, which have Blue Valley Industrial Corridor background values above the USEPA RSLs for industrial soil.

b. SWMU 4 and AOC 8: Lesser of the USEPA RSL for industrial soil or the USEPA Region 5 ecological screening level.

(1) Exceptions will be made for cadmium and lead, which have a site-specific ecological PRGs, and chromium and benzo(a)pyrene, which have Blue Valley Industrial Corridor background values above the USEPA Region 5 ecological screening levels and/or USEPA RSLs for industrial soil.

D. Soil Cover Material:

1. The soil cover material for the consolidation cell to be located within SWMU 4 shall meet the the following requirements:

a. Be classified as "CH", "CL", or "SC" material per the Unified Soil Classification System described in ASTM D2487.

b. Have a liquid limit greater than or equal to 20 and plasticity index greater than or equal to 10. Liquid limit and plasticity index shall be determined by ASTM D4318.

c. Have a hydraulic conductivity equal to or less than $1x10^{-5}$ centimeters per second as determined by ASTM D5084 when compacted within the acceptable placement range.

d. Have a minimum of 30% of the material passing through the No. 200 sieve (ASTM D1140).

e. Have a minimum of 100% of the material passing through the 1.5-inch sieve (ASTM D442).

f. Have a maximum of 5% organic content (ASTM D2974).

2. A series of tests will be performed on soil samples obtained at potential on-site borrow locations from varying depths. Tests to be included moisture content, compacted density, moisture versus compacted density (utilizing varying compactive efforts), classification, and hydraulic conductivity/permeability. Borrow areas will be tested to verify that the material is of sufficient quality and quantity.

3. Soil cover from the excavation areas (SWMUs 4 and 7 and AOC 8) shall be compacted within the consolidation cell to be constructed within SWMU 4. This is area is detailed in the project figures provided with this Interim Measures (IM) Workplan.
   a. Source identification shall be the responsibility of the Contractor.
   b. Source sampling, testing, and acceptable placement range development shall be under direction of a licensed Civil Engineer.
   c. Source sampling and testing shall be the responsibility of the Consultant.
4. The soil cover material shall not have any rock or gravel particles exceeding 3 inches in any dimension, and shall be kept free of all organic matter and foreign debris at the time of placement. If changes occur in material, as identified by the Consultant, the material shall not be placed until additional tests are performed by the Consultant.

E. Vegetative Soil:
1. Vegetative soil shall be a fertile, friable, and loamy soil of uniform quality, free from materials such as hard clods, stiff clay, stone with any dimension greater than 1 inch, and similar impurities. Relatively free from roots, weeds, and other objectionable plant material.

F. Non Contaminated Waste Materials as described for purposes of this Project within this Section consist of trash, excess usable materials, and materials unsuitable for use in the Work. Non Contaminated Waste Materials shall not include environmental pollutants, hazardous substances, contaminated products, by-products, samples, or waste materials of any kind that are regulated under environmental laws.

2.02 GRANULAR MATERIALS:

A. Backfill for remedial activities at SWMU 33 will consist of compacted aggregate.
1. Material shall have diameter no larger than 1 inch and will be able to meet compaction requirements.
2. If enough borrow material is identified on-site, it may be used as backfill in this area.

2.03 RIPRAP: NOT APPLICABLE.

PART 3 - EXECUTION

3.01 SITE PREPARATION:

A. Clearing and Grubbing:

1. Perform clearing and grubbing as indicated or as necessary to perform excavation, trenching, embankment, borrow, and other Work required, and where desired by Contractor for subsidiary purposes subject to approval:
   a. General:
      (1) Cleared material shall be chipped and stockpiled for use on proposed vegetative soil layer.
      (2) Root balls shall be burned on site, residual ash and earth material shall be transported to the consolidation cell. The following conditions will apply:
         (a) Burn location must be approved by Using Agency.
         (b) No burning on high PM or Ozone days. Ozone warnings will be issued the day before.
         (c) Air curtains are required. This can either be a pit designed for the use of a particular air curtain or a unit rented to hold what will be burned with an air curtain.
         (d) Contractor shall obtain a burn permit from the City of Kansas City, if required.
         (e) Contractor shall burn material in accordance with all applicable ordinances, laws, rules, and regulations.
   b. Clearing:
      (1) Includes felling and disposal of trees, brush, and other vegetation, generally above existing grade.
      (2) Conduct Work in a manner to prevent damage to property and to provide for the safety of employees and others.
      (3) Keep operations within property lines as indicated.
   c. Grubbing:
      (1) Includes removal and disposal of tree stumps and roots larger than 3 inches in diameter, generally below existing grade.
      (2) Remove to a depth of at least 6 inches below proposed grade elevation.
      (3) Backfill all excavated depressions with approved material and grade to drain.

B. Protection of Trees:
   1. Protect tops, trunks, and roots of existing trees on Project Site which are to remain, as follows:

a. Trees not within branch spread of proposed grading are to remain.

b. Box, fence around, or otherwise protect trees before any construction Work is started.

c. Do not permit heavy equipment or stockpiles within branch spread.

d. Trim or prune to obtain working space in lieu of complete removal when possible. Conduct operation as follows:

(1) With experienced personnel.

(2) Conform with good horticultural practice.

(3) Preserve natural shape and character.

(4) Protect cuts with approved tree paint.

e. Remove when damage occurs and survival is doubtful.

f. Replace with similar item when damaged due to carelessness or as indicated.

C. Pollution Controls:

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.

2. Do not apply water to point of saturation or to the extent where runoff is created.

3. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

3.02 EARTHWORK:

A. Consolidation Material:

1. The consolidation material that has been identified for placement in the consolidation cell shall be excavated in accordance with PART 3.02.B. Consolidation material shall be placed and compacted as an embankment material in accordance with PART 3.02.C. Field quality assurance for waste material placement shall be in accordance with PART 3.05.

a. As shown in the Project figures, consolidation material from SWMU 4, SWMU7 and AOC 8 will be consolidated in the vicinity of the deepest soil contamination in area comprising approximately 3 acres within SWMU 4.

b. Consolidation material that is mixed with unsuitable materials shall be structurally stabilized by drying, mixing with materials approved by the Engineer, or other methods approved by the Engineer.

2. The top 12 inches of the consolidation material on the consolidation cell (the 12 inches under the compacted soil cover) shall be placed, compacted, tested, and proof-rolled as a subgrade material in accordance with PART 3.02.D.
3. Final pay quantity (volume, cubic yards) for consolidation material shall be determined by survey of in-place material from the top of waste material subgrade to the top of finished waste material surface within the consolidation cell boundary.
4. The Consolidation Plan Drawings shall govern the movement of this material into the consolidation cell. All excavation shown outside the consolidation cell boundary on these Drawings shall be placed in the consolidation cell.
    a. Following the removal of consolidation materials, confirmation sampling will be performed to assess the nature of materials remaining in place.

B. Excavation:
1. Perform excavation as indicated or as required to complete the Work.
    a. Excavation depths and extents are provided in the Project figures.
2. Normal materials to be excavated are consolidation materials, waste materials, embankment and fill, vegetative soil, soil cover material, and other materials which can be removed by power shovel, loader, bulldozer, or other normal equipment, but not requiring the use of explosives or drills:
    a. Excavatable Rock:
        (1) Includes rock encountered in grading areas.
        (2) Excavate rock to depths as follows:
            (a) Under surfaced areas, to 6 inches below the top of respective subgrades.
            (b) Under vegetated areas, to 18 inches below finished grade.
    b. If large rock formations or boulders are encountered which are too large to excavate with conventional equipment, notify Engineer immediately. Do not proceed further until so instructed and measurements are made for establishing the volume of rock excavation. Large rock formations or boulders shall be worked around at no additional cost to Owner unless otherwise directed by the Engineer.
3. Blasting: Blasting will not be permitted.
4. Dewatering:
    a. General:

(1) Dewatering shall be in accordance with all local, state, and federal guidelines.

(2) Provide dewatering system of a sufficient size and capacity as required to control ground and surface water flow into the excavation and to allow all Work to be installed in a dry condition.

(3) Control, by acceptable means, all water regardless of source and be fully responsible for disposal of the water.

(4) Provide all necessary means for disposal of the water, including the obtaining of all necessary permits at no additional cost to Owner.

(5) Control groundwater in a manner that does not cause instability or raveling of the excavation slopes, and does not result in instability of proposed slopes.

(6) Open pumping with sumps and ditches shall be allowed, provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.

(7) Install, operate, and maintain the dewatering system required to control surface and/or groundwater.

(8) Control grading around excavations to prevent surface water from flowing into excavation areas.

(9) Drain or pump as required continually maintaining all excavations and trenches free of water or mud from any source, and discharging to approved drains or channels. Commence when water first appears and continue until Work is complete.

(10) Notify Engineer of persisting groundwater flow in excavated areas.

b. Design:

(1) Contractor shall provide dewatering plan at the time of Bid submission. Items to be provided shall include, but not be limited to the following:

(a) Make, model and capacities of pumps, prime movers, power generators, and standby equipment.

(b) Estimated flow rate of water to be discharged, and estimated duration for existing ponds to be drawn down to a dry condition as required for excavation.

(c) Detailed description of dewatering procedure and maintenance method for both groundwater encountered and pond dewatering.

(d) Additional details, as requested by Engineer.

(2) In preparing the dewatering plan, Contractor shall consider all available information, together with Site constraints, excavation/sheeting requirements, and construction schedule. Other potential problems may require specific reference and amplification within the dewatering plan.

(3) Contractor shall be solely responsible for proper design, installation, operation, maintenance, and any failure of any component of the system. Notice to Proceed issued by Owner or submittal of the dewatering plans and data by Contractor shall not relieve Contractor from full responsibility for errors therein, or for complete and adequate design and performance of the system in controlling the water level in the excavated areas, or for slope instability due to the presence of water in excavations regardless of source.

(4) Contractor shall be responsible for the accuracy of the drawings, design data, and operational records required by this Section.

c. Damages:

(1) Contractor shall be responsible for and shall repair without cost to Owner any damage to work in place, other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, and the excavation, including, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.

(2) Remove materials rendered unsuitable by excessive wetting and replace with approved material at no additional cost to Owner.

d. Maintaining Excavation in Dewatered Condition:

(1) Dewatering shall be a continuous operation when water is present in excavations, unless directed otherwise by the Engineer or Consultant. Interruptions due to power outages or any other reason shall not be permitted.

(2) Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and other construction until the critical period of construction and/or backfill is completed to prevent damage of subgrade support, piping, structure, side

slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.

(3) Provide standby equipment on site, installed, wired/fueled, and available, for immediate operation if required to maintain dewatering on a continuous basis in event any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damage at no additional cost to Owner.

(4) Subsequent to completion of excavation and during the installation of all Work in the excavated area, Contractor shall maintain the excavation in a dewatered condition.

e. System Removal:

(1) Contractor shall remove all temporary dewatering equipment from the Site, including related temporary electrical service.

(2) Removal work required under this paragraph does not include any of the site cleanup work as required elsewhere in these Specifications.

5. Stockpiling:

a. Stockpile material in amounts sufficient for and in a manner to segregate materials suitable for the following:

(1) Vegetative soil layer.

(2) Clean fill.

(3) Mulch from site clearing.

b. Do not obstruct or prevent access to:

(1) Roads and driveways.

(2) Utility control devices.

(3) Ditches or natural drainage channels.

c. Perform in a manner to avoid endangering the Work, stability of banks or structures, or health of trees and shrubs to be saved.

d. Maintain safe distance between toe of stockpile and edge of excavation or trench.

e. Maintain safe distance from overhead power lines.

f. Stockpile in location indicated on Drawings unless otherwise approved by the Engineer, Consultant, and the Using Agency.

g. Stockpile in other areas or off Site when adjacent structures, easement limitations, or other restrictions prohibit sufficient storage adjacent to the Work. Off-Site areas shall be arranged for by Contractor at no additional cost to Owner.

6. Onsite Borrow:
   a. Refers to all fill materials, soil cover material, and vegetative soil material obtained from approved onsite locations for placement in other locations.
   b. Onsite borrow shall include all excavating, handling, and final placement of materials as specified.
   c. Borrow areas shall be:
      (1) As indicated.
      (2) Arranged for by Contractor at no additional cost to Owner.
   d. Material removed from borrow areas shall be as approved per these specifications.
   e. Leave borrow areas graded to drain and to present a neat, natural appearance.
7. Offsite Borrow: Not Applicable.
8. Non Contaminated Waste Materials:
   a. Deposit such materials in locations and within areas approved by Consultant and the Using Agency
   b. Material unacceptable for placement on site shall become property of Contractor and shall be disposed of off Site at locations arranged for by Contractor at no additional cost to Owner.

C. Embankment and Fill:
1. Construct embankments and fill to the contours and elevations to match surrounding and to promote drainage, using suitable approved material from excavations and on site borrow areas:
   a. Placement:
      (1) Place fill material in maximum 8-inch layers.
      (2) Place embankment and fill only on subgrades approved by Consultant.
      (3) Do not place snow, ice, or frozen earth in fill; do not place fill on a frozen surface.
   b. Compaction:
      (1) Compact embankments and fill using equipment as required to obtain reasonable uniformity.

(2) Except as indicated otherwise, compact embankments and fill to 95% of maximum dry density within the moisture content range from 3 % below optimum to 3 % above optimum. Optimum moisture and maximum density shall be as determined by ASTM D6938.

(3) Compaction shall be as obtained by conventional methods and equipment during the placing and grading of layers and to the minimum density specified for particular locations.

(4) Perform moisture curing by wetting or drying of the material as required to attain required compaction criteria. Suitable materials may be mixed with embankment or fill materials to attain specified moisture content.

(5) Achieve minimum densities specified.

D. Subgrades:

1. General:
   a. Excavate or fill as required to construct subgrades to the elevations and grades similar to surrounding and to promote drainage.
   b. Remove all unsuitable material and replace with approved fill materials.
   c. Perform all wetting, drying, shaping, and compacting required as necessary to prepare a suitable subgrade.
2. Subgrade for Fills and Embankment: Roughen by discing or scarifying. Wet or dry top 6 inches, as required, to bond with fill or embankment.
3. Subgrade for Soil Cover:
   a. Extend subgrade the full width of the soil cover (cap) plus 1 foot outside the edges of the overlying course to be placed.
   b. Subgrade material shall not have rock or gravel particles larger than 2 inches in any dimension within the upper 3 inches.
   c. Compact the top 6 inches of soil cover to 95% of maximum dry density within the moisture content range from 3% below optimum to 3% above optimum. Optimum moisture and maximum dry density shall be determined by ASTM D6938.

E. Site Grading:

1. Rough Grading:
   a. All areas within the Project, including excavated and filled sections, and adjacent transition areas shall be reasonably smooth, compacted, and free from irregular surface changes.

b. Degree of finish shall be that ordinarily obtained from pan scraper operations, except as otherwise specified.

c. Finished rough grades shall generally be not more than 0.5 foot above or below established surrounding grade.

d. Finish all ditches, swales, and gutters to drain readily.

e. Provide rounding at top and bottom of banks and at other breaks in grade.

F. Compacted Soil Cover Layer (on Consolidation Cell within SWMU 4):

1. Compacted Soil Cover Subgrade:

a. Construction of the soil cover shall not begin until the subgrade has been prepared in accordance with PART 3.02.D.

2. Compacted Soil Cover Placement:

a. Construct soil cover to the contours, dimensions, and elevations to match surrounding and to promote drainage.

b. On sloped areas, place cover soil from the bottom of the slope upward to create a passive, stabilizing soil wedge at the toe of the slope prior to placing soil higher on a slope.

c. The compacted soil cover shall be developed, in general, by compacting successive 6-inch to 8-inch thick layers of approved soil material for a total compacted soil cover thickness of not less than twenty four (24) inches. Contractor shall provide sufficient manpower to remove visible rock or gravel particles larger than ¾-inch during placement and processing of the soil cover material.

d. Soil cover material shall be placed in loose lifts not exceeding 6 to 8 inches in thickness.

e. Soil cover material shall be processed after placement with a pulver mixer, rotovator, road reclaimer, or other similar approved processing equipment if necessary so that the maximum soil clod size does not exceed one (1) inch in any dimension.

(1) Processing of soil cover material, if necessary, shall occur after placement of material unless otherwise approved by Engineer.

(2) Processing, if necessary, may be performed at separate moisture adjustment area as approved by Engineer.

(3) Processing shall extend a minimum of 1 inch into successive underlying lifts.

f. Final compacted thickness of each lift shall not be greater than 6 inches.

g. Compact each lift so that the in-place dry unit weight and moisture content are within the acceptable placement zone provided at the end of this section.

h. Adjust moisture content of soil cover material as follows:

(1) In amounts less than 3% after placement, but prior to processing and compaction. Moisture content may be adjusted less than 3% during the processing stage if the processing equipment allows for direct addition of water and processing equipment will produce a uniformly mixed material with even moisture distribution.

(2) In amounts up to and greater than 3%.

(a) Prior to placement at a separate location.

(b) In a maximum 12-inch thick loose layer of material.

(c) With tilling equipment such that the soil cover material will wet or dry evenly.

(3) With a distributor bar or other approved equipment that will distribute moisture evenly and at a constant rate.

i. Soil placement "seams" typically occurring at the edges of the truck or scraper width shall be staggered. Stagger placement seams between overlying and underlying lifts a minimum of 5 feet.

j. Compacted soil cover that shall not receive additional lifts in the next 14 hours shall be protected by one of the following:

(1) Sealing the surface with a flat wheel roller and placing temporary (removable) covers approved by Engineer over the area. Anchor covers by means that will not damage the compacted soil cover.

(2) Placing a minimum thickness of 6 inches of loose soil cover material on the surface of the compacted soil cover. Moisture content of loose soil cover material shall be tested prior to resuming soil cover construction. If moisture content adjustment is required, adjustment of 3% or less may be made in place as specified in this Section. If greater than 3% adjustment is required, the loose soil cover material shall be removed and adjustments made at a separate location as specified in this Section.

(3) If the full compacted depth has not been placed, processed, compacted and tested and was protected by placing a minimum thickness of 6 inches of protective cover material (not to be used as soil cover material) on the

surface of the compacted soil cover, the loose, temporary soil cover material must be completely removed prior to finishing the acceptable soil cover material lift.

k. Protect compacted soil cover from damage caused by freezing, desiccation, or other harsh exposure conditions.

l. Protect the compacted soil cover after placement of the final lift until it is covered by the nominally compacted vegetative soil.

m. If the soil cover is damaged by exposure, remove the lift, adjust the moisture content if required, and recompact to meet the requirements of this Section.

n. The top 6 inch thickness of compacted cover shall not contain rock or stone particles larger than 0.5 inches in maximum dimension.

G. Vegetative Soil Layer (on Consolidation Cell):

1. Vegetative soil shall be obtained from on site borrow areas which are most suitable for such purposes.

2. Placement of Vegetative Soil:

a. Distribute over required areas without compaction, other than nominal compaction obtained with low ground pressure spreading equipment.

b. The total vegetative soil layer thickness shall not be less than specified and shall be verified by survey as specified in PART 3.05. This survey shall also be the basis for payment. If offsite borrow is necessary, two such surveys shall be required to determine the quantity of material used from each source.

3. Maintenance:

a. After vegetative soil has been spread, clear surface of stones or other objects larger than 1 inch in thickness or diameter and all other objects that might interfere with planting and maintenance operations.

b. After placement and seeding, protect vegetative soil areas from the elements (wind, precipitation, and excessive drying) until grass is established and repair eroded areas as required.

c. Keep paved areas clean. Promptly remove vegetative soil or other dirt dropped upon surfacing.

d. The vegetative soil cover will be mowed twice per year.

3.03 GRANULAR MATERIALS:

A. Granular aggregate fill shall be rodded, spaded, and consolidated as necessary to provide firm uniform support, and shall not subject area to settlement or displacement.

3.04 RIPRAP: NOT APPLICABLE.

3.05 FIELD QUALITY CONTROL:

A. All Work described in this Section shall be as shown and specified. The Consultant shall determine if the work performed satisfactorily meets the design requirements and shall provide recommendation to the Using Agency as to the acceptability of the Work. Any work deemed unacceptable shall be reworked by Contractor at no additional cost to Owner.

B. Onsite Borrow:

1. Perform material evaluation and testing as required by this SECTION to determine if material is suitable for the intended purpose. Material shall be subject to the approval of the Consultant.
2. Chemical Testing:
   a. Method Summary: Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required, and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, continuous flight auger, a trier, a split-spoon, or, if required, a backhoe. Sampling methods should follow methods described in a in a project specific Missouri Department of Natural Resources (MDNR) approved Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs).
   b. Quality Assurance (QA) and Quality Control (QC): All sampling activities should follow procedures and methods described in a project specific MDNR approved QAPP and SOPs.
   c. Borrow Area Sampling:
      (1) Sample Area Preparation:
         (a) For soil that has not been disturbed. The area for source material should be divided into parcels of approximately 2 acres.
            1) If soil borings are to be excavated, then four borings to the depth of the soil to be removed should be selected and placed

evenly over every 2 acre area. The composite sample will be over the entire depth of the sample. The 4 borings from each grid should be composited together to form 1 composite sample per 2 acres grid.

2) If the area to be sampled is gridded then sampling grids of 50 feet by 50 feet should be established within the parcels.

(b) A 5 point composite should be taken in each sampling grid. Use stakes, flagging, or buoys to identify and mark all sampling locations. Composite samples include the corners and the center for each sampling grid.

(c) Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned sampling devise prior to sample collection.

(d) Samples should be taken at two different intervals depending on the depth of excavation. Shallow samples consist of those at 3-24 in and deep samples of 24-48 in.

(e) For soil that has already been stockpiled. Two composite samples should be collected from a stockpile of 20,000 cubic yard. If the stockpile is greater than 20,000 cubic yards then an additional two composite samples will need to be taken. Each composite sample should be made up of at least 5 aliquots.

(2) Sample collection:

(a) Volatile Organic Compounds (VOCs) sample collection should be completed using a Terracore sampling kit and described in approved QAPPs and SOPs.

(b) Other samples should be collected after proper mixing for each composite. Samples should be taken in appropriate jars following recommendations depending on the analysis needed and laboratory requirements. Required analyses are listed below.

(3) Decontamination Procedures:

(a) If non-dedicated equipment is used to collect soil samples, the equipment should be decontaminated following procedures described in project specific MDNR approved QAPP and SOPs.

(4) Required Analyses:

(a) Samples should be analyzed following approved U.S. Environmental Protection Agency (USEPA) Methods as described in the MDNR approved project QAPP. Analyses must include the following:

1) VOCs, and

2) Resource Conservation and Recovery Act (RCRA) metal list.

(5) Approval:

(a) Based on where the borrow soil will be place, soil analytical results will be compared to the following screening criteria:

1) SWMU 4/AOC 8 – Site-specific Ecological PRG for lead of 140 milligrams per kilogram (mg/kg).

2) SWMU 7 – Site-specific PRG for lead of 1,531 mg/kg.

3) SWMU 33 – Industrial screening level for TCE of 6.4 mg/kg or the SPLP analysis above the CMS Screening Level for groundwater of 0.005 milligrams per liter (mg/L).

(b) Exceptions to these screening criteria will be accepted in accordance with PART 2.01.

(c) Sample results should be submitted to Using Agency for approval prior to excavation and use of borrow material.

C. Embankments, Fills, and Subgrades:

1. Consultant will test all embankments, fills, and subgrades under this Contract to determine conformance with specified density relationships.
2. Method of test shall be ASTM D6938.
3. The frequency of tests will be generally 2 per acre per lift or more as deemed necessary by the Consultant.
4. Deficient areas shall be isolated by additional tests, if necessary, and repaired by the Contractor at no additional cost to the Owner.
5. Repaired areas shall be retested by the Consultant.

D. Subgrades:

1. Consultant will inspect all subgrades to determine conformance with indicated lines or surrounding grades. Acceptance of subgrades by the Consultant shall be required prior to placing material over subgrades.

a. Subgrades shall be proofrolled to detect localized zones of excessively wet, unstable, organic, or low bearing capacity materials to the extent as follows:

(1) Proofroll as a single-pass operation with conventional compaction equipment during subgrade preparation and prior to placement of fill, and as a spot check process without the need for complete coverage per unit area of tire. Soft spots will be overexcavated, backfilled and compacted with suitable material.

E. Consolidation Material Confirmation Sampling:

1. Prior to closure of consolidation cell, confirmation sampling shall be performed on the excavated surfaces and Consultant shall issue acceptance of consolidation activities based on confirmation sampling test results.
2. Consultant shall collect one (1) confirmation sample per 900 square feet (ft^2) of excavation. Confirmation samples will be analyzed as defined below:
   a. SWMU 4/AOC 8 and SWMU 7 – Lead via USEPA SW-846 Method 6010.
   b. SWMU 33 – VOCs using Terracore sampling kits and analyzed via USEPA SW-846 Method 8260.
3. Laboratory analysis of samples will be used to document the nature of materials remaining in place.
4. Sampling grids of 30 feet by 30 feet should be established over the excavation area.
   a. A 5 point composite should be taken in each sampling grid. Use stakes, flagging, or buoys to identify and mark all sampling locations. Composite samples include the corners and the center for each sampling grid.
   b. Any exposed sidewalls resulting from excavation/consolidation activities will have a sample collected per every 45 linear feet.
   c. QA/QC samples will consist of one duplicate sample for every 20 samples collected, or a minimum of one per day if less than 20 samples are collected per day.
5. Consultant shall conduct confirmation sampling after the planned excavation depths and extents have been achieved and prior to backfilling to document the nature of materials remaining in place.
6. Chain of custody documentation will be completed as appropriate. Each confirmation sample will be placed in an iced cooler (to maintain a temperature of 4° Celsius) and submitted to an approved off-site analytical laboratory. Upon receipt of laboratory results, the analytical data will be validated for submittal in the Remedial Action Report.

F. Compacted Soil Cover:

1. The Consultant shall perform duties, including, but not limited to construction observation, sampling, and soils testing.
   a. The Consultant shall have the authority to request additional hydraulic conductivity tests in the areas that, in the Consultant's judgment, may be suspect or deficient. Hydraulic conductivity tests shall be conducted in accordance with ASTM D5084. For each sample tested, one back-up sample will be extracted in the proximity of the sample location. This sample will be held in a controlled environment at the laboratory as a precautionary measure. If adequate demonstration is presented that a sample was not representative of the soil cover or that an error in testing occurred, the backup sample will be tested and the original test will be disregarded.
   b. Any sample or area tested shall be rejected, removed and replaced if it does not meet the requirements of the Contract Documents. Reconstructed areas shall have feathered, overlapping edges that tie into adjacent liner areas.
2. Compacted Soil Cover Surveying:
   a. Surveyor shall be a Licensed Professional Land Surveyor in the State of Missouri and shall be retained and compensated by the Contractor.
   b. Establish a uniform grid over the soil cover placement area not to exceed 100 feet between grid points. In addition, grid points shall be established at the top, mid-point and base of all slopes and other locations of breaks in grade within the soil cover placement area. Pipes and channels shall be surveyed at flow lines not more than 50 feet between points and at ends and breaks in alignment.
   c. Perform a survey and determine vertical elevations at each grid point.
   d. Submit plan drawings indicating the location of each grid point and the vertical elevations upon completion of both the subgrade surface and the top of compacted soil cover surface, verifying that the required soil cover thickness has been obtained. Submit plan drawings indicating the location of each grid point and the vertical elevations upon completion of the vegetative soil layer, verifying that the required vegetative soil layer thickness has been obtained to protect compacted soil cover. Survey drawings shall be signed and sealed by a Professional Land Surveyor registered in the State of Missouri.
   e. Finished subgrade and top lift of compacted soil cover surface elevations shall be completed within 0.1 feet plus or minus of the indicated grade. The total compacted

soil cover thickness shall not be less than specified (two feet), and the surface elevation of the top of compacted soil cover shall be completed within 0.1 feet plus or minus of the indicated grade. Minimum design slopes of the cover surface shall be maintained.

3.06 PAYMENT: NOT APPLICABLE.

3.07 PROTECTION OF THE WORK:

A. Correction of Settlement:

1. Under provisions of the guarantee, Contractor is responsible for correcting any settlement and damages created thereby within 1 year after acceptance of the Work.
2. Settlement may be identified by visual observation or survey.
3. Consultant shall determine if repairs are necessary based on the significance of the settlement and the location of the settlement.
4. Contractor shall make repairs within 10 days from and after due notification by Consultant of settlement and resulting damage.
5. Make arrangements for access to the Site for purposes of repair.

END OF SECTION 312000

SECTION 312300 - EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.01 SUMMARY: This Section covers the furnishing of all labor and equipment for excavation and backfill.

1.02 REFERENCES:

A. Applicable Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. T99 - The Moisture-Density Relations of Soils Using a 5.5-Pound (2.5-kg) Rammer and a 12-Inch (305-mm) Drop.
2. American Society for Testing and Materials (ASTM):
   a. STP 479 – Special Procedures for Testing Soil and Rock for Engineering Purposes.
   b. D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3).
   c. D2167 - Test Method for Density and Unit Weight of Soil In-Place by Rubber Balloon Method.
   d. D2487 – Classification of Soils for Engineering Purposes.
   e. D4253 - Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   f. D4254 - Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   g. D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   h. D4546 - Test Methods for One-Dimensional Swell/Settlement Potential of Cohesive Soils.
   i. D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
   j. D2487 – Classification of Soils for Engineering Purposes.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS:

A. Cohesionless materials in accordance with the Unified Soil Classified System, ASTM D2487, include gravels, gravel-sand mixtures, sands, and gravelly sands exclusive of clayey and silty

material; materials which are free-draining and for which impact compaction will not produce a well-defined moisture-density relationship curve and for which the maximum density by impact methods will generally be less than by vibratory methods.

B. Cohesive materials in accordance with the Unified Soil Classification System, ASTM D2487, include silts and clays generally exclusive of sands and gravel; materials for which impact compaction will produce a well-defined moisture-density relationship curve.

C. Waste Materials: Includes excess suitable material and material unsuitable for use in the Work as defined in SECTION 312000 Part 2.01.

D. Consolidation Materials: Includes materials suitable for use in the Work as defined in SECTION 312000 Part 2.01.

E. Borrow Materials:

1. Includes all backfill and topsoil obtained from approved locations on the jobsite.
2. Material shall be subject to approval of the Engineer.
3. Borrow areas shall be as follows:
   a. Arranged for by Contractor at no additional cost to Owner.
   b. Subject to approval of the Engineer.

F. Granular Backfill Material:

1. Material shall be crushed rock or crushed natural gravel with the following gradation, conforming to ASTM D448 #57, if available:

Sieve Size	Percent Passing
1-1/2 inch	100
1 inch	95-100
1/2 inch	25-60
No. 4	0-10
No. 8	0-5

1. At SWMU 33, granular aggregate material will be placed to bring the excavated area to grade.

G. Topsoil Materials: Includes suitable approved non-waste material from the top 6 inches of all excavated areas.

H. Soil Cover Materials:

1. The soil cover material for the consolidation cell to be located within SWMU 4 shall meet the the following requirements:

a. Be classified as "CH", "CL", or "SC" material per the Unified Soil Classification System described in ASTM D2487.

b. Have a liquid limit greater than or equal to 20 and plasticity index greater than or equal to 10. Liquid limit and plasticity index shall be determined by ASTM D4318.

c. Have a hydraulic conductivity equal to or less than $1x10^{-5}$ centimeters per second as determined by ASTM D5084 when compacted within the acceptable placement range.

d. Have a minimum of 30% of the material passing through the No. 200 sieve (ASTM D1140).

e. Have a minimum of 100% of the material passing through the 1.5-inch sieve (ASTM D442).

f. Have a maximum of 5% organic content (ASTM D2974).

2. A series of tests will be performed on soil samples obtained at potential on-site borrow locations from varying depths. Tests to be included moisture content, compacted density, moisture versus compacted density (utilizing varying compactive efforts), classification, and hydraulic conductivity/permeability. Borrow areas will be tested to verify that the material is of sufficient quality and quantity.

3. Soil cover from the excavation areas (SWMUs 4 and 7 and AOC 8) shall be compacted within the consolidation cell to be constructed within SWMU 4. This is area is detailed in the project figures provided with this Interim Measures (IM) Workplan.

a. Source identification shall be the responsibility of the Contractor.

b. Source sampling, testing, and acceptable placement range development shall be under direction of a licensed Civil Engineer.

c. Source sampling and testing shall be the responsibility of the Consultant.

4. The soil cover material shall not have any rock or gravel particles exceeding 3 inches in any dimension, and shall be kept free of all organic matter and foreign debris at the time of placement. If changes occur in material, as identified by the Consultant, the material shall not be placed until additional tests are performed by the Consultant.

I. Backfill Materials:

1. Includes suitable approved material from onsite borrow areas.

2. Shall be friable sandy or silty clay containing fine material sufficient to provide a dense mass free of voids and capable of satisfactory compaction.

3. At SWMU 33, granular backfill will be as specified above in SECTION 2.01 Part E.

J. Materials unsuitable for use in backfill and fill include:

1. All material that contains debris, roots, organic matter, frozen matter, or other materials that are determined by Engineer as too wet or otherwise unsuitable for providing a stable fill, subgrade, or foundation for structures.
2. Material containing gravel, stones, or shale particles greater in dimension than one-half the depth of the layer to be compacted.
3. Excavated materials from SWMU 33 designated for offsite disposal.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILL:

A. All material within the excavation shall be removed to the indicated depth. All precautions necessary to prevent collapse of the walls, blowouts and disturbance of the bearing soil shall be taken.

B. Should the Engineer verify that the backhoe has met refusal, which is defined as less than 5 inches of penetration with one pass using a Caterpillar 225 hydraulic excavator with 8'-0" stick, 24-inch width bucket and ripper teeth, then the material removed from that elevation shall be defined as rock. Contractor shall not be paid for rock removal for excavation without Engineer's verification and measurement.

C. Blasting is expressly forbidden.

D. All material replaced shall be compacted sufficiently as follows:

1. Cohesive Soils: Compaction shall be a minimum of 95 percent maximum density with a moisture content ±3 percent of optimum moisture per ASTM D1557.
   a. Cohesionless Soils: Compaction shall be a minimum of 75 percent relative density as determined by ASTM D4253 and D4254.

E. Snow, ice or frozen earth shall not be placed in fills and fills shall not be placed on frozen earth.

END OF SECTION 312300